SPEEDIE AND ASSOCIATES
Geotechnical ▪ Environmental ▪ Materials Engineers

www.speedie.net

Registered Professional Engineer (Civil)
CERTIFICATE NO.
37292
KEITH R.
GRAVEL
Date Signed 7/15/19
ARIZONA, U.S.A.

FINAL REPORT ON GEOTECHNICAL INVESTIGATION

DESIGNATION: Union Office Complex - Mesa

LOCATION: NWC Cubs Way & Riverview Auto Drive, Mesa, Arizona

CLIENT: Lincoln Property Company

PROJECT NO: 181744SA

DATE: July 15, 2019

3331 East Wood Street ■ Phoenix, AZ 85040 ■ Phone (602) 997-6391 ■ Fax (602) 943-5508
2026 North 3rd Street ■ Flagstaff, AZ 86004 ■ Phone (928) 526-6681 ■ Fax (928) 526-6685
3125 East 47th Street ■ Tucson, AZ 85713 ■ Phone (520) 514-9411 ■ Fax (520) 514-9474

TABLE OF CONTENTS

Registered Professional Engineer (Civil)
CERTIFICATE NO.
37292
KEITH R.
GRAVEL
Date Signed 7/15/19
ARIZONA, U.S.A.

1.0 INTRODUCTION

This report presents the results of a subsoil investigation carried out at the site of the proposed Union Office Complex. The site is located at the northwest corner of Cubs Way and Riverview Auto Drive in Mesa, Arizona.

We understand that design will consist of a multi building office complex with two parking garages. Although site plans are not finalized, it is expected that the office buildings will be 4-5 stories and the parking structures will be 3 to 4 stories. Structural loads are expected to be moderate to heavy and no special considerations regarding settlement tolerances known at this time. For the purposes of design, it is assumed that columns loads will be on the order of 700 kips for office buildings and 1500 kips for garages. Adjacent areas will be landscaped or paved to support moderate volume passenger and low volume service truck traffic. Landscaped areas and below grade concrete vaults with drywells will be utilized for storm water retention and disposal.

Speedie and Associates conducted a Phase I Environmental Site Assessment (ESA) under separate cover (Report 180737EA, dated May 18, 2018 and reissued June 27, 2018). The report was reviewed for potential buried geotechnical hazards that could affect the proposed development. Review of environmental hazards is not within the scope of this report. The reader is referred to the ESA report for further details.

Speedie and Associates previously conducted limited geotechnical investigations at the subject site (Speedie reports 120372SA, dated October 31, 2012 and 140358SA, dated March 18, 2014). These were reviewed in preparation of this report. The field and laboratory data is included in the Appendix B.

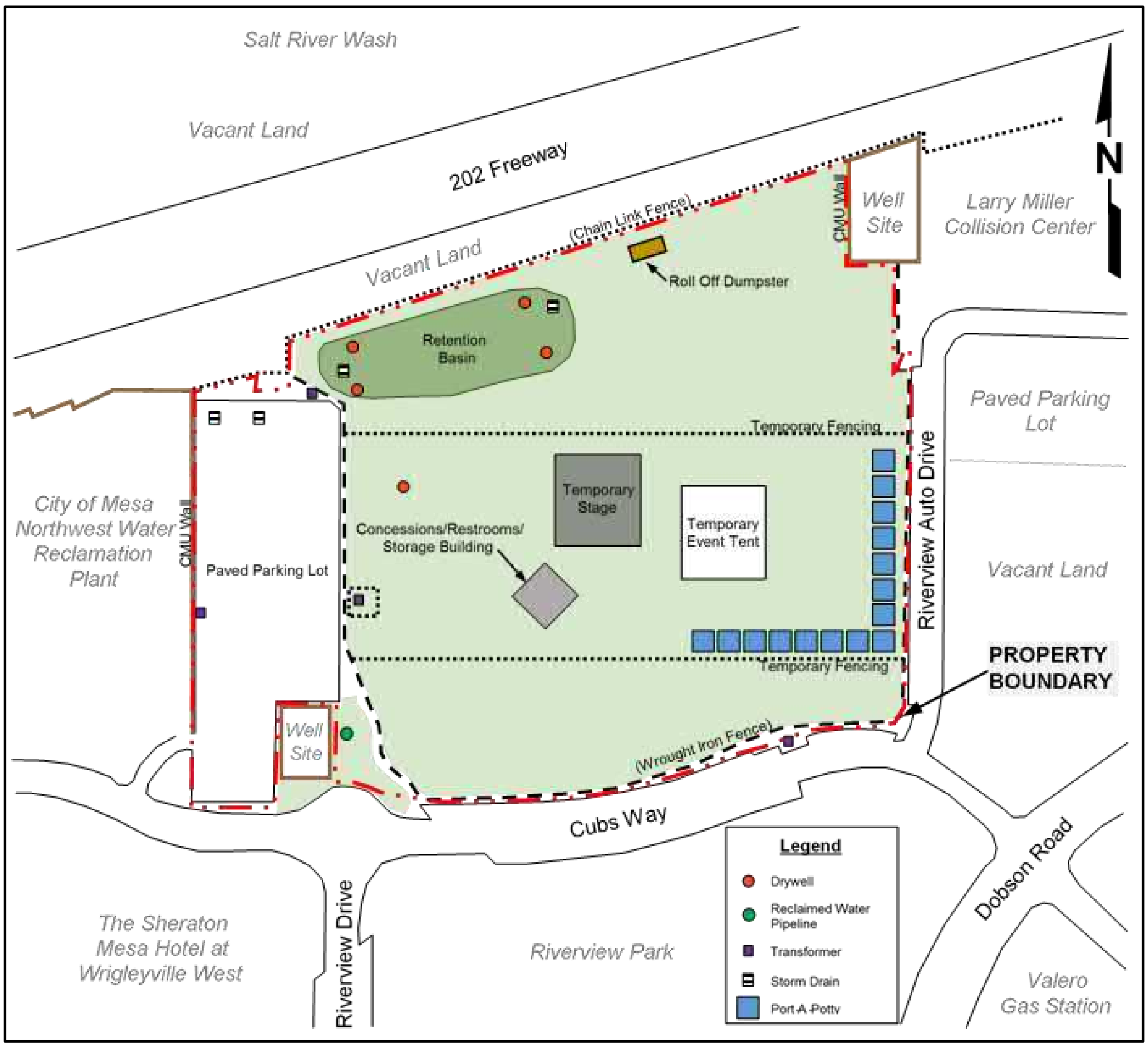
2.0 GENERAL SITE AND SOIL CONDITIONS

2.1 Site Conditions

The site is bounded on the north by a landscaped area followed by the Loop 202 Freeway followed by parkland and the Salt River hard bank, on the south by Cubs Way followed by the Sheraton Mesa Hotel at Wrigleyville West and Riverview Park, on the east by Riverview Auto Drive, and on the west by City Mesa Northwest Water Reclamation Plant. The site is currently used as a soccer field and has a 2850 square foot building (concession stand) located in the middle. Sports field style light poles are located throughout the field. The west side of the site is a paved parking area with access drives. A buried landfill area is located along the north side of the site. A deep retention basin (approximately 15 feet deep) with 4 drywells is located in the northwest corner of the site. A fifth drywell is located south of the retention basin. A well site and reclaimed water lines are located near the southeast corner of the site. The site is generally at lower elevation than the surrounding pavement areas.

A Phase I ESA previously conducted at the subject site by Speedie and Associates (Report 180737EA, reissued June 27, 2018) was reviewed as part of the current investigation. At the time of that site reconnaissance, the subject Property consisted of 28.17 acres of a public park owned by the City of Mesa and paved parking lot. The Property surface generally consisted of concrete, pavement, and bare soil with landscaping that included grass, trees, bushes, and shrubs. The western portion of the Property contained a paved parking lot. Two (2) storm drains were observed on the north end of the parking lot. Surface staining from parked vehicles was observed throughout the parking lot. Other important features associated with the site can be seen in the following Figure obtained from the ESA report.

Figure 2.1.1



Historically, the Property appeared to be vacant land along the south bank of the Salt River as early as 1930. The southern portion of the Property appeared to be part of an agricultural field. No significant changes were visible on the Property in 1937. In the early to late 1940s, a wastewater treatment plant was developed on the western portion of the Property. A tank, aeration ponds, and other equipment associated with the reclamation plant were visible on the Property in 1949. In the early 1950s, the south bank of the Salt River appeared to extend through the northern portion of the Property. In 1957, excavated areas indicative of landfill activities were visible along the south bank of the Salt River and on the subject Property. The wastewater plant appeared to have expanded in the 1960s and 1970s. Landfill activities were still apparent on the northern portion of the Property. In 1979, a small concession building and softball fields were developed on the eastern portion of the Property. No significant changes were visible on the Property in the 1980s. In the early 1990s, the water treatment plant had been cleared and redeveloped to the west of the Property. The western portion of the Property was used as a temporary construction yard associated with development on the adjoining properties and/or was vacant. The Property appeared unchanged between 1993 and 2013. In 2014, the softball fields were cleared and redeveloped as a grass field with a concession building. A retention basin was developed along the northern portion of the Property. The western portion of the Property was developed as a paved parking lot. The Property appeared essentially the same from 2015 to 2018.

A previous structure associated with a former wastewater treatment plant was located on the western portion of the Property possibly as early as 1948. Given the time frame of when the structure was present (Pre-1940s to the 1990s) it is possible that the structure in this area was serviced by septic system(s), water well(s), private trash pit(s) and/or private fuel systems (ASTs/USTs). Refer to the following historical aerial photos for further details.

Figure 2.1.1 – Dated 1930

Figure 2.1.2 – Dated 1949

Figure 2.1.3 – Dated 1959

Figure 2.1.4 – Dated 1969

Figure 2.1.5 – Dated 1979

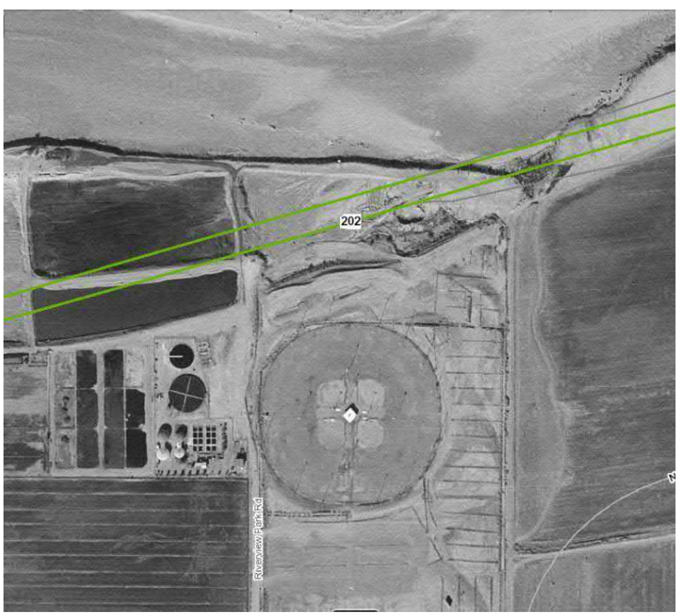


Figure 2.1.6 – Dated 1996

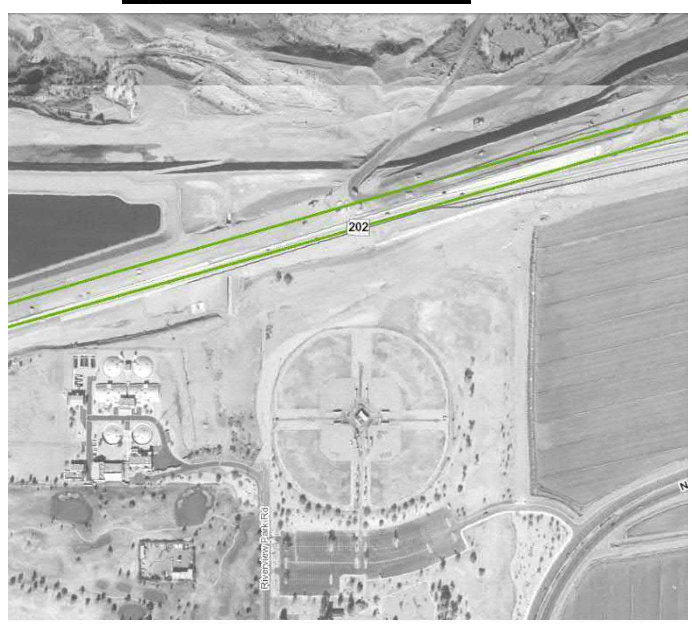


Figure 2.1.7 – Dated 2000

Figure 2.1.8 – Dated 2016

2.2 General Subsurface Conditions

The following presents a high-level summary of the data in **previous reports by Speedie**. Due to the high variability, any written description would be cumbersome and/or confusing. Boring Logs and Test Pit Logs from the investigations that were located in the subject site area are presented in Appendix A and B of this report. One should read these full reports for more detailed information. The subject site contains undocumented fill discovered in some borings drilled and test pits excavated across the subject site. The subject site is located on currently vacant land (soccer fields) and paved parking lots. Based on review of previous reports by Speedie and Associates listed below, we know that a portion of the site is located in an area that was previously used as a wastewater treatment facility (west side paved parking lot) and aggregate mining/landfill (north side). The mined pits have been backfilled with municipal waste with variable soil cover discussed below. Review of all this date indicates that there is nil to ~10 feet of soil cover overlying a landfill/soil mass that extends to 14 feet below existing grade. The soil cover fill consists mostly of clayey sand, silty sand and sandy lean clay soils with varying percentages of gravel and cobbles. The underlying landfill materials are typical of municipal waste including mixed organic and solid materials mixed with soil.

The following tables are a summary of the soil profile from previous Speedie investigations at the Boring/Pit locations referenced. The reader is referred to the appendix for further details.

Table 2.2.1 - Speedie Report 120372SA, Dated October 31, 2012

Test Pit	**Soil Profile(1)**	**Comments**
TP-1 No GW @ 23’	0-2’ SM (fill) 2-12’ SM (fill) Gravel, Cobbles w/Trash Debris 12-14’ Possible Fill with ash 14-23’ Native SGC	Trash debris mixed with soil
TP-2 No GW@14’	0-2’ Clayey Sand (Fill) 2-5’ Clayey Sand (Fill) w/ Trash Debris 5-10’ Native Clayey Sand 10-14’ Native SGC	Trash debris mixed with soil
TP-3 No GW@14’	0-2’ Clayey Sand (Fill) 2-11’ Clayey Sand (Fill) w/ Trash Debris 11-14’ Native SGC	Trash debris mixed with soil
TP-4	0-5’ Native SGC	
TP-5	0-2’ Clayey Sand (Fill) 2-5’ Clayey Sand (Fill) w/ Trash Debris 5-8’ Native SGC	Trash debris mixed with soil
TP-6 No GW@15’	0-2’ Clayey Sand (Possible Fill) 2-15’ Native Clayey Sand	
TP-7 No GW@15’	0-3’ Clayey Sand (Fill) w/Trash Debris 3-15’ Native Clayey Sand, Sandy Clay	Trash debris mixed with soil
TP-8	0-3’ Native Clayey Sand 3-6’ Native Silty Sand 6-9’ Native SGC	
TP-9	0-3’ Native Clayey Sand 3-5’ Native Silty Sand 5-9’ Native SGC	

Notes:

1. Soil cover interpolated
2. No Ground Surface Elevations Provided
3. SM=Silty Sand; SGC=Sand, Gravel and Cobbles

Table 2.2.2 - Speedie Report 140358SA, Dated March 18, 2014

Boring	**Profile**	**Comments**
B-1	0-3’ Native Lean Clay 3-8’ Native Sand with Silt 8-11.5’ Native Poorly Graded Sand	
B-2	0-3’ Native Lean Clay 3-6’ Native Poorly Graded Sand w/silt 6’-7.5’ Native Clayey Sand 7.5-11.5’ Native Well Graded Sand	

Based on the **current investigation**, the existing pavement (west parking lot) comprises 3.0 inches of asphalt concrete over 5 to 6 inches of silty sand with gravel and/or cobbles where drilled. Although the subsoils were not identified as ‘fill’, there is good reason to believe that undocumented fills (and remnant buried structures from the former reclamation facility) exist below the pavement area. According to a recent ESA conducted by Speedie and Associates (report 180737EA), we are not aware of documentation of facilities removal or a Phase II being conducted. **Landfill** was apparently localized in the north part of the site (see borings B-4, B-12 to B-14, T-2, and T-3) and depth varied between 2 and 14 feet below existing grade. The fills were generally in a **loose** state. Loose native soils were encountered below the landfill in some locations to depths on the order of 18 feet below grade. Based on the 2012 investigation (see report 120372SAa in Appendix B) the landfill samples tested at about 4 % organics, but also contained metal, glass and plastic pipe. The report also indicated that pockets of higher organic and/or debris content may exist. The **native upper soils outside the fill/landfill areas** generally comprised **loose** upper clayey sand and sandy lean clay underlain by silty sand and poorly graded sand to depths of 10 to 18 feet below grade. These were underlain by sand gravel and cobble of varying gradation (known local as ‘SGC’) to 51.5 feet below grade, the maximum depth of penetration. Tubex drilling equipment was required to advance into cobble-laden soils. **Shallow auger refusal** on cobbles was encountered using standard drilling equipment at depths of 3 to 5 feet below grade in several locations (B-4, B-11, and B-13 to B-16). Standard Penetration Test values generally range from 2 to 15 blows per foot in the upper 10 to 15 feet (with higher values in some locations). SPT Values in increase to 50+ blows per foot in the lower SGC soils.

Laboratory testing from the **current investigation** indicates in-situ dry density of the upper soils in the range of 90 to 105 pcf and water content in the range of 6 to 20 percent at the time of investigation. Liquid limits are in the range of non-plastic to 36 percent. Plasticity indices range from non-plastic to 18 percent. The upper clay soils exhibit volume increase due to wetting of approximately 1.1 to **4.5 percent** when compacted to moisture and density levels normally expected during construction. Undisturbed samples displayed minor to **significant** compression (1.5 to 7%) during initial incremental loading and negligible to **significant** additional compression (0.1 to 9%) due to inundation under maximum confining loads of 3,200 to 6,400 psf.

2.3 Seismic Design Parameters

The project area is located in a seismic zone that is considered to have low historical seismicity. The seismicity of the Phoenix area has had only two magnitude 3.0 events in over 100 years.

Although borings were not advanced to 100 feet, based on the nature of the subsoils encountered in the borings and geology in the area, a Site Class Definition, Class C may be used for design of the structures bearing on engineered fill or deep foundations. In addition, the following seismic parameters may be used for design (based on 2008 USGS maps adopted by 2012/15 IBC):

Table 2.3.1 Seismic Parameters

	Class C
MCE[1] spectral response acceleration for 0.2 second period, S_S:	0.183g
MCE[1] spectral response acceleration for 1.0 second period, S_1:	0.060g
Site coefficient, Fa:	1.2
Site coefficient, Fv:	1.7
MCE[1] spectral response acceleration adjusted for site class, S_{MS}:	0.219g
MCE[1] spectral response acceleration adjusted for site class, S_{M1}:	0.101g
5% Damped spectral response acceleration, $S_{DS:}$	0.146g
5% Damped spectral response acceleration, $S_{D1:}$	0.067g
NOTE 1: MCE = maximum considered earthquake	

2.4 Geological Conditions

The site is **located well outside known areas** that have undergone considerable subsidence due to groundwater removal. Areas of subsidence are known to produce earth fissuring, which has affected areas within the metropolitan Phoenix area. Subsidence is a basin wide phenomenon that would result in differential elevation changes over long distances, which would not affect the type of buildings proposed for this site. No evidence of earth fissures were observed on the site. Fissure gullies form over subsurface irregularities such as bedrock highs, which cause tensional stresses and differential subsidence. Where such anomalies are not present, subsidence tends to be uniform over a wide area, this having minimal effect on surficial structures. The closest known earth fissures are located in Scottsdale and in East Mesa, many miles from this site. Based on local experience, subsidence and earth fissures historically have **not** been a problem in this area.

2.5 Groundwater

Groundwater was not encountered during the current (2018) geotechnical investigation by Speedie and Associates to depths of 51.5 feet below grade, the maximum depth of penetration. However, groundwater levels can vary seasonally and/or according to flow volumes in the Salt River and its tributaries. According to Speedie Report 180737EA, ADWR well records within a mile of the site groundwater was reportedly measured at elevations of 1079 to 1140 feet above mean sea level (depths of 36 to 132 feet below grade).

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Analysis

Field-testing indicates that generally subsoils (including landfills) at the site are generally NOT suitable for support of the moderately to heavily loaded structures on shallow spread footings and slab-on-grade construction unless significant remedial earthwork is conducted. Deep foundations (drilled shafts or GeoPiers) are recommended as the primary option.

The areas of the landfill are **not suitable** for the support of the proposed structures on shallow foundation and slab-on-grade. These areas will require a large amount of earthwork to be acceptable for building foundations. There are several options (discussed below) and sub-options that may be utilized for the area of the fill.

The **west parking lot (paved)** was previously the location of a known water reclamation facility between the 1940's and 1970's. We are not aware of documentation regarding the removal/remediation of the structures and settling ponds. Some of the facilities were 15 feet deep or more. Boreholes B-11 and B-10 are the closest borings, but did not encounter fills or structures. Exact locations of the former structures/ponds are not known. Therefore, it is possible that the borings missed them. The proposed parking garage will cover most of the existing parking area. Therefore, special remedial work is recommended to aid in detection of potential buried hazards. We recommend complete removal of undocumented fills, loose/soft soils (if any) and remnant foundations and utilities (if any remain). In order to provide uniform support **deep foundations are recommended**.

Some areas of the site (see boring B-7) contain deep soft clay soils that potentially will undergo long-term settlement if surcharged 'as is' (grade fill added). If any settlement sensitive structures or utilities are planned in this area then the soft soils must be remediated. Remediation consists of complete removal and replacement with engineered fill or deep foundation support (drilled piers or GeoPiers).

The deep **retention basin** at the northwest corner of the site will require some remedial before it can be backfilled. Remedial work should include over-excavation and removal of soft and/or wet soils.

<u>Landfill Area (Option 1)</u>

Remove trash and re-compact the entire undocumented fill zone from under the building pads, critical (gravity) utility areas, and critical surface parking lots. This option would require excavations down to 14± feet (or deeper depending on field monitoring) and potentially 18± feet in order to remove underlying loose soils. The overlying cover soils ranging from ~1 to 10 feet deep are suitable for re-use as engineered fill. It appears that some of the landfill (trash) material is organic and may not re-used as engineered fill. If there are large cobbles or pieces of concrete, they will require crushing to re-use. The concrete may be included in the engineered fill provided it meets the requirements for engineered fill. The re-use of the material up to 12 inches in size is discussed below. This is primarily an option for deeper fill areas and critical areas outside the building. In order to facilitate utility trenching it is recommended that the fill be limited to a maximum size of less than 3 inches in the top 5± feet of the building pads and shallow utility trench areas. Larger size materials are acceptable in deeper building pad fill and outside of the building pads.

The trashy fills will be more difficult to process. This fill reportedly primarily consists of plastic, metal, glass, ash, and discolored soil. In the test pits uncovered, the percentage deleterious material is not known with certainty. Based on visual inspection, the makeup of the fill is being found to be variable. If a process is implemented which will remove the deleterious material and discolored soil, the clean soil may be re-used. Environmental monitoring will be required. It is recommended that the suitable soil in this fill area be stockpiled and tested to ensure it meets the environmental regulations for re-use as backfill material in accordance with the environmental Soil Management Plan. If/where such a process cannot be implemented or is deemed too costly, then the trashy fills should be removed in their entirety, disposed of properly, and replaced with clean fill.

<u>Landfill Area (Option 2)</u>

This option would involve partial removal and re-compaction of the deeper fills. These fills **should be removed full depth within** any proposed building areas and critical (gravity) utility/roadway areas. This removal ideally should extend at least a width equal to the depth of removal outside of the building perimeter and any contiguous sidewalk areas. For 14 feet of fill, that means 14 foot width plus what is required for temporary back slope. We understand that there may be areas where this width is not attainable such as the encroachment near the 202 right of way on the north side. Where the excavation is shored, the width of fill beyond the edges of foundations may be reduced to a nominal 2 feet if the soils beyond the shoring line are relatively decent. As the mass excavation progresses, representatives of this office will determine if the contiguous landfill mass appears to be stable enough to support the engineered fill and allow the lateral extent to be reduced at the pinch points (i.e. north side). **Just be absolutely sure that all footing projections are included.** The more space given, the less chance for footings extending out beyond over the engineered fill zone. On those sides that are unsuitable trash, provide **at least 5 feet** of fill beyond the footing edges. Again, critical areas such as entry landings, wet utility corridors and hardscape where differential settlement can be tolerated need to be addressed. If not on engineered fills, other means of support will be required.

The balance of the **trashy fill** may remain under the paved and landscaped areas only if the owner(s) is (are) willing to risk future localized settlement in this remaining area. The pavement areas should be expected to experience some distress and require additional maintenance if this option is chosen. It is difficult to predict the amount of post construction settlement due to the nature and variability of the materials. Water infiltration is usually the driving force in post construction settlement of granular fills. The usual source is irrigation and/or storm water drainage/retention. Based on an average depth of fill and/or loose soil of 15 feet, we predict a maximum potential of settlement on the order of **24 inches** should the fill become saturated. Preventing saturation will reduce the potential. It may be possible to greatly reduce this potential by pre-soaking the area causing any loose zones or void spaces to infill and settle before pavement is installed. A major factor in reducing potential long-term settlement is minimizing infiltration of water into the fills. It should be expected that over the long term fissures could open up at the transitions between remediated and un-remediated areas. Ongoing maintenance will be required to remediate the fissures and provide grading to mitigate surface water infiltration.

It is reported by contractors on other landfill site along the River, landfills were over excavated under proposed new pavement areas down to ~5 feet below finish grade, installed a layer of geo-grid, then placed ~4 feet of engineered fill then another layer of geo-grid and then the pavement structural section. This appeared to reduce (not eliminate) the differential settlement of the parking lot and should be considered on this project as well for temporary parking areas. This option of partial removal and one layer of geo-grid (Tensar BX1200 or better) and 12 inches of well graded granular fill should also be used in the proposed landscaped areas around the office buildings to reduce (not eliminate) the potential for sinkhole formation. Long-term maintenance should be expected. Top soil above that reinforced grid payer should be specified by the Landscape Architect.

Due to the potential for and unpredictable nature of post construction settlement, it is recommended to also remove all fills full depth within a ±10 foot wide swath along proposed sanitary sewer line, water line and storm drain line corridors to be replaced with engineered fill or ½ sack CLSM. Another option is to used drilled shaft (or other deep foundation alternate) supported grade beams to support utility waterlines, sewer lines, duct banks etc. If this treatment prism is not extended to cover the full width of the pavement and sidewalks, expect long-term settlement issues.

West Parking Lot

Lacking information on the removal and remediation of the water reclamation facility formerly located in the west parking lot area, we recommend that the entire footprint of the proposed garage including drives and sidewalks be over-excavated to aid in detection of potential buried hazards. Buried structures and undocumented fills should be completely removed along with soil disturbed by removal. Site preparation for wet utilities is the same as recommended (above) for landfill areas.

Determination of the highest groundwater elevation during flood events is beyond the scope of work for this report. Ground water is not expected to be a factor in the design or construction of shallow foundations and shallow underground utilities. It could have an impact on deep foundations, and deeper utilities if any are anticipated. It will have a negative impact on the use of drywells for storm water disposal by limiting the depth of wells.

For standard spread foundations to perform as expected, attention must be paid to provide proper drainage to limit the potential for water infiltration of deeper soils. It is assumed that the landscape plan will use mostly low water use or "green" desert type plants (xeriscape). It is preferred to keep irrigated plants at least 5 feet away from structures with irrigation schedules set and maintained to run intermittingly. **Unpaved planter areas should be sloped at least 5 percent for a distance of at least 10 feet away from the building.** It is understood that this may not be possible due to ADA maximum slope requirements for the adjacent sidewalks and patios. The slope may be reduced to 2 percent provided extra care is taken to ensure sidewalks and other hardscape features do not create a “dam” that prevents positive drainage away from the buildings, creating a "pond" adjacent to the building. Roof drainage should also be directed away from the building in storm drains or paved scuppers. Pre-cast loose splash blocks should not be used as they can be dislodged and/or eroded. Roof drains should not be allowed to discharge into planters adjacent to the structure. It is preferred that they be directed to discharge to pavement (per photo example), retention basins or discharge points located at least 10 feet away from the building.

It is reiterated that shallow spread footings bearing on engineered fill are provided as an option for major structures since this may be a more economical system. However, this shallow system relies on the dry strength of the unsaturated fill and native soils. Saturation of deep engineered fills could result in excessive differential settlement. Recognizing the need to minimize significant water penetration adjacent to the building perimeter that could detrimentally impact the building foundation, the following additional recommendations are made to protect foundations:

1. Take extra precaution to backfill and compact native soil fill to 95 percent in all exterior wall locations.
2. Retention basins should be located at least 10 feet away from proposed structures.
3. Create and maintain positive drainage away from the exterior wall for a minimum of 10 feet. **Surface stormwater retention basins should be kept at least 20 feet away from structure foundations.**
4. Avoid sidewalks, curbs or other elements that create a dam that could cause water to pond within 5 feet of the perimeter wall.
5. Include no irrigated landscape materials in the first 3 feet next to the building.
6. Between 3 feet and 5 feet, include only landscape materials that can be irrigated with a maximum of 1 gallon per hour emitter heads. Set and maintain irrigation controllers to prevent 24/7 flows.
7. Any landscape materials requiring greater than 1 gallon per hour irrigation, including turf, shall be at least 5 feet from the outside face of the building.
8. All irrigation feeder lines, other than those that supply individual emitters, shall not be placed closer than 5 feet to the building.

For exterior slabs-on-grade, frequent jointing is recommended to control cracking and reduce tripping hazards should differential movement occur. It is also recommended to pin the landing slab to the building floor/stem wall. This will reduce the potential for the exterior slab lifting and blocking the operation of out-swinging doors. Pinning typically consists of 24-inch long No. 4 reinforcing steel dowels placed at 12-inch centers.

3.2 Site Preparation

In general, the entire area to be occupied by the proposed construction should be stripped of all vegetation, debris, trash, rubble, **undocumented fills**, and obviously loose surface soils. Remnant foundation elements (if any remain) should be removed in their entirety along with soil disturbed by this activity (if removals are planned). Carefully remove all concrete and other elements as well as any deleterious materials that may be encountered. The entire affected building pad areas should be over-excavated at least 18 inches to aid in location and removal of other buried hazards (i.e. foundations, utilities, septic systems, trash pits, silage pits, etc.). If encountered, they should be removed and the resulting excavation widened as necessary to provide access for compaction equipment. Special attention will need to be given to landfill areas (north side), former reclamation facility (west parking lot), wells, and areas of deep soft clay soils as discussed below.

If **Landfill (Option 1)** is chosen for the north part of the site, all of the fill must be removed full depth from the building, contiguous sidewalks, and critical pipeline and pavement areas. The removed non-organic materials may be reused as engineered fill provided over-sized materials, if encountered (> 3-6 inches) are removed. With the owner's permission, over-sized materials (6-12 inches) may be used in selected non-building fill areas provided sufficient fines are mixed to prevent nested voids. It may be possible to process the landfill materials to remove the organic materials saving the better materials for fill preferably under pavements.

If the owner elects to leave the fill in the north part of the site per **Landfill (Option 2)**, the extent of fill removal should extend laterally a distance equal to the depth of removal or at least 25 feet beyond the building pad where possible and any contiguous sidewalk areas. See comments above in Section 3.1 - Option 2 for reductions in lateral extent under special circumstances. **Due to the potential for and unpredictable nature of post construction settlement, it is recommended to also remove all fills full depth within a 10+ foot wide swath along the proposed sanitary sewer line, water line and storm drain line corridors to be replaced with engineered fill or CLSM.** All of the trashy debris must still be removed and disposed of properly. Additional environmental sampling and testing may be required to characterize the waste before removal from the site. Care should be taken during excavation not to endanger nearby elements such as roadways, utilities, etc. Depending on proximity, existing elements may require shoring, bracing or underpinning to provide structural stability and protect personnel working in the excavation.

There may be areas where loose sand is encountered below the bottom of the landfill. Where that occurs, additional removal and re-compaction may be required depending on the final lower level floor elevations and/or foundation option chosen. There may be areas encountered during construction where landfills extend below the estimated depths. The landfills should be over-excavated to native soils.

In the **west parking lot area and for other proposed construction areas** the entire footprint of the proposed structures including drives and sidewalks should be over-excavated at least 18 inches to aid in the detection of potential buried hazards (such as foundations, tank bottoms, pond liners, utilities, septic systems, undocumented fills, etc.). If encountered, these should be completely removed along with soil disturbed by removal. Excavations should be widened as necessary to allow access for compaction equipment.

It is not known whether existing underground services will be removed. If any utility is located within 5 feet of any proposed foundation, relocation and/or abandonment of the utility should be provided. They should either be removed and replaced with engineered fill or abandoned in-place. In the case of manholes and pipelines, it may be possible to abandon them in-place. The tops of manholes should be removed and filled with M.A.G. Spec 728 CLSM 1½ sack cementitious grout. Pipelines larger than 6 inches should be capped and filled with grout. If the contractor decides to abandon the pipes in-place, the onus should be put on him to demonstrate that the trench backfill is adequately compacted. Speedie and Associates should be notified of the circumstance for our review. If removal of a pipeline is not possible, the foundations should be deepened to bear in undisturbed soil so that the zone of influence under the foundation does not encroach on the pipeline and/or trench. This zone is any area below a 45° line drawn down and away from the bottom of the foundation edges.

Open-cut excavation appears feasible for the majority of the excavation depending on proximity of the proposed excavation to sidewalks, streets and presumably underground utilities. All excavations must comply with current governmental regulations including the current OSHA Excavation and Trench Safety Standards. Based on the borings, the bulk of the fill is Type C in accordance with OSHA Standards, 29 CFR Part 1926, October 31, 1989, due to the loose to medium dense sandy soils and deleterious material. Based on these classifications and the OSHA 29 CFR Part 1926, October 31, 1989 Standards, the maximum allowable cut slopes are 1½:1. Adjustments to the recommended slopes may be necessary due to wet zones, loose strata and other conditions likely to occur in the fill material. Localized shoring may also be required. Shotcrete or soil stabilizer on the slope face may be useful in preventing erosion due to run-off and/or drying of the slope. The excavation should be continually monitored for potential safety concerns.

In all areas, prior to placing structural fill, the exposed grade should be scarified to a depth of 12 inches, moisture conditioned to optimum (±2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698. This may require partial over-excavation depending on equipment in order to facilitate compaction. Pavement areas should be scarified, moisture conditioned and compacted in a similar manner.

All cut areas and areas above footing bottom elevation that are to receive new floor slab only fill should be scarified 8 inches, moisture conditioned to at least optimum to 3 percent above optimum and lightly but uniformly compacted to 90 to 95 (max) percent of maximum dry density as determined by ASTM D-698.

As noted above, there are ground water monitoring wells located on this site. While it is assumed that these wells were installed on behalf of the City, legal ownership and/or easement for placement on the subject site are not known. Those that are located within proposed building pads will need to be abandoned and removed in accordance with AZ Department of Water Resources (ADWR) rules and regulations by registered well contractors. Those that fall outside of the building pads may be of some future value to the owner. The owner should decide if they want to salvage any wells and reset the caps/well vaults at proposed finished grade.

3.3 Foundation Design

If site preparation is carried out as set forth herein, the following bearing capacities can be utilized for design of the various buildings and garages. Differing foundations types (for example footings and drilled shafts) should generally be avoided within the same structure unless accommodation for increased differential settlement can be accommodated. Using drilled shaft caissons to extend the foundation loads down into the denser SGC surface may be more economically viable.

Table 3.3.1 Foundation Bearing Capacities

Option	Foundation Type	Foundation Depth(1)	Bearing Medium	Bearing Capacity	Comments
Minor Structures	Spread	1.5 ft.	Compacted Subgrade	1,500 psf	2
Office and Garage Structures	Spread	5 ft.	5 ft. Engineered Fill	5,000 psf	3
		5 ft.	10 ft. Engineered Fill	10,000 psf	4
	GeoPiers™	~15 ft.	Native Medium Dense/Stiff Soils	~5 to 8 ksf	5
	Drilled shafts	20 ft.	Dense Native Soil	(See Curves)	6

Comments:

1. Foundation Depth refers to the minimum depth to bottom of footing elevation **below existing site elevation** or lowest finished grade within 5 feet, whichever is deeper.
2. For minor structures such as screen walls, planter walls, canopies etc. not connected to any main structure. The bottom of footing excavation should moisture-conditioned to optimum (±2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698.
3. Shallow spread footing bearing **on 5 feet of engineered fill**. Continuous and square footings should **not exceed 3.5 feet and 7 feet respectively** to stay within settlement tolerances. If column loads greater than **245 kips** are required then increased over-excavation is recommended (see note 5, below) See Detail 3.3.1.
4. Shallow spread footings bearing on **10 feet of engineered fill**. Continuous and square footings should **not exceed 7 feet and 15 feet respectively** to stay within settlement tolerances. If column loads greater than **1500 kips** are required then deep foundations are recommended. Detail 3.3.1.
5. GeoPier™ is a proprietary foundation system typically designed by the specialty contactor. Contact Craig P. Streit LEED AP. at **W**estern **G**round **I**mprovement, 250 Goddard, Irvine, Ca., 92618 (Ph) 949 218-7032, (Cell) 480 250-2862 or ken@**W**estern**G**round**I**mprovement.com www.westerngroundimprovement.com
6. Drilled shafts should have a minimum tip depth of **20 feet** below **existing grade** to contact dense native soils. Shaft deepening will be required locally if sand or loose soil are encountered at tip depth or if the grade is raised. Drilled shafts (caissons) rely heavily on end-bearing and skin friction below the engineered fill zone. Engineered fill will be subject to some settlement and negative skin friction. Down drag has not been added to the shafts as the settlement of the fill is assumed to be minimal. Down drag through trash will be greater. Contact this office if drilling through trash becomes necessary.

Continuous wall footings and isolated rectangular footings should be designed with minimum widths of 16 and 24 inches respectively, regardless of the resultant bearing pressure. Lightly loaded interior partitions (less than 800 plf) may be supported on reinforced thickened slab sections (minimum 12 inches of bearing width and 12 inches deep).

Drilled shafts should consist of foundations bearing in the very dense SGC. A minimum tip depth of 20-feet **below existing grade** is recommended. **Deepening of shaft tips will be required locally where sand or loose soils are encountered or if grade is raised.** The sandy overburden soils are not suitable for under-reaming by belling. Accordingly, design and construction should assume straight shafts. Sloughing should be expected in the sand layers resulting in concrete quantities higher than neat dimension calculations. **Casing and/or 'wet' drilling techniques will be required for caving and construction below the water table (if water is encountered).** A minimum shaft diameter of 42-inches is recommended to allow access for cleaning and inspection. Due to safety concerns from caving and potential groundwater pressures, entering drilled shafts for inspection is not recommended. All drilled shafts should be examined by a representative of the Geotechnical Engineer to verify cleaning, depth, dimensions and proper bearing strata. Straight shaft drilled shafts may be "machine cleaned" provided the contractor can show the ability to adequately remove loose material. Adjacent drilled shaft base (tip) elevations should not vary by more than 45-degrees.

A minimum allowable distance of 3 drilled shaft diameters, center-to-center, is recommended between drilled shafts and rock sockets for reasons of construction safety and to reduce **axial** group action. This limitation ensures that newly placed drilled shafts are not damaged during the subsequent placement of adjacent drilled shafts. This distance may be reduced to 2 diameters if one of the drilled shafts has been in place for enough time to allow concrete to set and cure. A load bearing reduction factor of 0.7 should be applied to individual drilled shafts within a proximity of two diameters, center-to-center, of each other. If adjacent drilled shafts are of different diameters, an average of the diameters should be used for determining spacing. A separate set of group reduction factors should be applied for **lateral** load conditions. Speedie and Associates should be contacted if these are required. Alternatively, p-y modification factors can be used. Lateral load analysis of shafts can be provided on request (at additional cost).

Estimated settlements under design loads are on the order of 0.5 to 1-inch, virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supporting soils were to experience a significant increase in moisture content. **Positive drainage away from structures, and controlled routing of roof runoff must be provided and maintained to prevent ponding adjacent to perimeter walls.** Planters requiring heavy watering should **not** be placed adjacent to or within 5 feet of the building. Care should be taken in design and construction to insure that domestic and interior storm drain water is contained to prevent seepage. Roof drainage should be directed to paved areas or storm drains. They should not discharge into planters adjacent to the structures.

3.4 Lateral Pressures

The following lateral pressure values may be utilized for the proposed construction:

Active Pressures	
Unrestrained Walls	35 pcf
Restrained Walls	60 pcf
Passive Pressures (in engineered fill, no trash)	
Continuous Footings	300 pcf
Spread Footings or Drilled Piers	350 pcf
Coefficient of Friction (w/ passive pressure)	0.35
Coefficient of Friction (w/out passive pressure)	0.45

All backfill must be compacted to not less than 95 percent (ASTM D-698) to mobilize these passive values at low strain.

3.5 Fill and Backfill

Native soils and fills lacking organics are considered suitable for use as engineered fill. On-site fill and cobble material may also be used as engineered fill provided that any deleterious material and plus 3-inch material is first removed for fills placed within 3 feet below finished grade. In the deeper fills, 6 to 12 inch size materials may be used provided that the contractor can demonstrate the ability to place and compact with sufficient fines to prevent nesting of voids. Other location restrictions should be considered to reduce the negative impact on utility or other underground construction that may be required. Existing asphalt may be milled in place to a gradation meeting import fill requirements and stockpiled for reuse later as subbase.

Imported common fill for use in site grading and engineered fill may be required. It should be examined by a Geotechnical Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious/hazardous materials. It should have 100 percent passing the 3-inch sieve and no more than 60 percent passing the 200 sieve. For the fine fraction (passing the 40 sieve), the liquid limit and plasticity index should not exceed 30 percent and 10 percent, respectively. It should exhibit less than 1.5 percent swell potential when compacted to 95 percent of maximum dry density (ASTM D-698) at a moisture content of 2 percent below optimum, confined under a 100 psf surcharge, and inundated.

Relaxed standards for deeper engineered fills under the building and parking lots will be acceptable as approved by this office. In general, the maximum size may be increased to 6 inches and the plasticity index may be increased to not exceed 15 percent. It should exhibit less than 3 percent swell potential.

The native silty and fine sand soils may be sensitive to excessive moisture content and could become unstable at elevated moisture content. Accordingly, it may be necessary to compact these soils on the dry side of optimum, especially in asphalt pavement areas. The reduced moisture content under slabs-on-grade should only be used upon approval of the engineer in the field.

Fill should be placed on subgrade, which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ±2 percent (optimum to +3 percent for underslab fill). Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per ASTM D-698 set forth as follows:

A.	Building Areas		
	1.	Below footing level (fills < 5 feet)	95
	2.	Below footing level (fills $\geq$ 5 feet)	98
	3.	Below slabs-on-grade (non-expansive soils)	95
	4.	Below slabs-on-grade (expansive soils) (Not recommended in the upper 12 inches of Pad)	90-95
B.	Pavement Subgrade or Fill		95
C.	Utility Trench Backfill		95
D.	Aggregate Base Course		
	1.	Below floor slabs	95
	2.	Below asphalt paving	100
E.	Landscape Areas		90

3.6 Utilities Installation

Trench excavations for shallow utilities can be accomplished by conventional trenching equipment; however, the presence of cobbles and coarse fills may require heavier duty equipment. The fact that a boring was drilled to a certain depth does not mean that the soils may be excavated by normal means. The excavating contractor must make his/her own assessment as to excavatability. Trench walls **may not** stand near vertical for the short periods of time required to install shallow utilities or shoring. Some sloughing will occur in looser and/or sandier soils requiring laying back of side slopes and/or temporary shoring. Adequate precautions must be taken to protect workmen in accordance with all current governmental regulations.

Backfill of trenches may be carried out with native excavated material provided oversize materials are removed. This material should be moisture-conditioned, placed in 8-inch lifts and mechanically compacted. Water settling is not recommended. Compaction requirements are summarized in the "Fill And Backfill" section of this report.

3.7 Slabs-On-Grade

To facilitate fine grading operations and aid in concrete curing, a 4-inch thick layer of granular material conforming to the gradation for aggregate base (A.B.) as per M.A.G. Specification Section 702 should be utilized beneath the slab. Dried subgrade soils **must** be re-moistened prior to placing the aggregate base if allowed to dry out, especially if fine-grained soils are used in the top 12 inches of the pad.

The native soils are capable of storing a significant amount of moisture and shallow water table, which could increase the natural vapor drive through the slab. Accordingly, if moisture sensitive flooring and/or adhesive are planned, the use of a vapor barrier or low permeability concrete should be considered. Vapor barriers should be a minimum 15-mil thick polyolefin (or equivalent), which meets ASTM E 1745 Class A specifications. Vapor barriers do increase the potential for slab curling and water entrapment under the slab. Accordingly, if a vapor barrier is used, additional precautions such as low slump concrete, frequent jointing and proper curing will be required to reduce curling potential and detailed to prevent the entrapment of outside water sources.

3.8 Asphalt/Concrete Pavement

If earthwork in paved areas is carried out to finish subgrade elevation as set forth herein, the subgrade will provide adequate support for pavements. The location designation is for reference only. The designer/owner should choose the appropriate sections to meet the anticipated traffic volume and life expectancy. The section capacity is reported as daily ESALs, Equivalent 18 kip Single Axle Loads. Typical heavy trucks impart 1.0 to 2.5 ESALs per truck depending on load. It takes approximately 1,200 passenger cars to impart 1 ESAL.

<u>Pavement Design Parameters</u>:

Assume:	One 18 kip Equivalent Single Axle Load(ESAL)/Truck
Life:	20 years
Subgrade Soil Profile:	
% Passing #200 sieve:	59%
Plasticity Index:	12%
k:	150 pci (assumed)
R value:	30 (per ADOT tables)
M_R:	18,400 (per AASHTO design)

Table 3.8.1 Pavement Sections

<table>
<tr><th rowspan="3">Area of Placement</th><th colspan="3">Flexible (AC Pavement)</th><th colspan="2">Rigid (PCC Pavement)</th></tr>
<tr><th colspan="2">Thickness</th><th rowspan="2">Daily 18-kip ESALs</th><th>Thickness</th><th rowspan="2">Daily 18-kip ESALs</th></tr>
<tr><th>AC (0.39)</th><th>ABC (0.12)</th><th>PCCP</th></tr>
<tr><td>Auto Parking</td><td>2.0"</td><td>4.0"</td><td>2</td><td>5.0"</td><td>6</td></tr>
<tr><td rowspan="3">Truck Parking, Main Drives, & Fire Lanes</td><td>3.0"</td><td>4.0"</td><td>11</td><td>6.0"</td><td>17</td></tr>
<tr><td>3.0"</td><td>6.0"</td><td>25</td><td>7.0"</td><td>39</td></tr>
<tr><td>3.0"</td><td>8.0"</td><td>53</td><td>8.0"</td><td>85</td></tr>
</table>

Notes:

1. Designs are based on AASHTO design equations and ADOT correlated R-Values.
2. The PCCP thickness is increased to provide better load transfer, and reduce potential for joint & edge failures. Design PCCP per ACI 330R-87.
3. Full depth asphalt or increased asphalt thickness can be increased by adding 1.0-inch asphalt for each 3 inches of base course replaced.

These designs assume that all subgrades are prepared in accordance with the recommendations contained in the "Site Preparation" and "Fill and Backfill" sections of this report, and paving operations carried out in a proper manner. If pavement subgrade preparation is not carried out immediately prior to paving, the entire area should be proof-rolled at that time with a heavy pneumatic-tired roller to identify locally unstable areas for repair.

Pavement base course material should be aggregate base per M.A.G. Section 702 Specifications. Asphalt concrete materials and mix design should conform to M.A.G. 710 for heavy traffic. It is recommended that a ½ inch or ¾ inch mix designation be used for the pavements. While a ¾ inch mix may have a somewhat rougher texture, it offers more stability and resistance to scuffing, particularly in truck turning areas. Pavement installation should be carried out under applicable portions of M.A.G. Section 321 and municipality standards. The asphalt supplier should be informed of the pavement use and be required to provide a mix that will provide stability and be aesthetically acceptable. Some of the newer M.A.G. mixes are very coarse and could cause placing and finish problems. A mix design should be submitted for review to determine if it will be acceptable for the intended use.

For sidewalks and other areas not subjective to vehicular traffic a 4-inch section of concrete will be sufficient. For trash and dumpster enclosures a thicker section of 6 inches of concrete is recommended.

Portland Cement Concrete Pavement must have a minimum 28-day flexural strength 600 psi (compressive strength of approximately 4,000 psi). **It may be cast directly on the prepared subgrade** with proper compaction (reduced) and the elevated moisture content as recommended in the report **provided all joints are sealed. The contractor may elect to use a nominal thickness of compacted aggregate subbase to aid in fine grading and concrete placement.** Lacking an aggregate base course, attention must be paid to using low slump concrete and proper curing, especially on the thinner sections. The daily ESAL's capacities calculated are based on plain jointed design; no reinforcing is necessary. Joint design and spacing should be in accordance with ACI recommendations. Construction joints should contain dowels or be tongue-and-grooved to provide load transfer. Tie bars are recommended on the joints adjacent to unsupported edges. Maximum joint spacing in feet should not exceed 2 to 3 times the thickness in inches. Joint sealing with a quality silicone sealer is recommended to prevent water from entering the subgrade allowing pumping and loss of support. **If joints are not sealed, add a 4-inch aggregate subbase** to the pavement to reduce the potential for loss of support where water enters the joints.

Proper subgrade preparation and joint sealing will reduce (but not eliminate) the potential for slab movements (thus cracking) on the expansive native soils. Frequent jointing will reduce uncontrolled cracking and increase the efficiency of aggregate interlock joint transfer.

4.0 GENERAL

The scope of this report includes only regional published considerations for seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, not any site specific studies. The scope does not include any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data and the recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a representative of the Geotechnical Engineer observe and test the earthwork and foundation portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

Respectfully submitted,
SPEEDIE & ASSOCIATES, INC.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
14388
GREGG ALAN
CREASER
Date Signed 7/15/19
ARIZONA, U.S.A.

Gregg A. Creaser, P.E.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
37292
KEITH R.
GRAVEL
Date Signed 7/15/19
ARIZONA, U.S.A.

Keith R. Gravel, P.E.

APPENDIX A

(Current Geotechnical Investigation)

FIELD AND LABORATORY INVESTIGATION

SOIL BORING LOCATION PLAN

SOIL LEGEND

LOG OF TEST BORINGS

TABULATION OF TEST DATA

CONSOLIDATION TEST

MOISTURE-DENSITY RELATIONS

SWELL TEST DATA

DRILLED SHAFT CAPACITY CURVES

FIELD AND LABORATORY INVESTIGATION

From September 6 to 10, 2018, soil test borings were drilled at the approximate locations shown on the attached Soil Boring Location Plan. All exploration work was carried out under the full-time supervision of our staff engineer, who recorded subsurface conditions and obtained samples for laboratory testing. The soil borings were advanced with a truck-mounted CME-75 drill rig utilizing 7-inch diameter hollow stem flight augers and using a Tubex downhole hammer rig to advance through coarse-grained deposits. Detailed information regarding the borings and samples obtained can be found on an individual Log of Test Boring prepared for each drilling location.

Laboratory testing consisted of moisture content, dry density, grain-size distribution and plasticity (Atterberg Limits) tests for classification and pavement design parameters. Remolded swell tests were performed on samples compacted to densities and moisture contents expected during construction. Compression tests were performed on a selected ring sample in order to estimate settlements and determine effects of inundation. All field and laboratory data is presented in this appendix.

- APPROXIMATE SOIL BORING LOCATIONS

N

SOIL BORING LOCATION PLAN

SHEET: 1 of 1 | DR: JCM | REV: | DATE: 09/13/18 | PROJECT NO. 181744SA

UNION OFFICE COMPLEX - MESA

NWC CUBS WAY & RIVERVIEW AUTO DRIVE

MESA, ARIZONA

SPEEDIE AND ASSOCIATES

GEOTECHNICAL • ENVIROMENTAL • MATERIALS ENGINEERS

SOIL LEGEND

SAMPLE DESIGNATION	DESCRIPTION	
AS	**Auger Sample**	A grab sample taken directly from auger flights.
BS	**Large Bulk Sample**	A grab sample taken from auger spoils or from bucket of backhoe.
S	**Spoon Sample**	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoon sampler into undisturbed soil for three successive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blows for the final 12 inches of penetration is the Standard Penetration Resistance.
RS	**Ring Sample**	Driving a 3.0 inch outside diameter spoon equipped with a series of 2.42-inch inside diameter, 1-inch long brass rings, into undisturbed soil for one 12-inch increment by the same means of the Spoon Sample. The blows required for the 12 inches of penetration are recorded.
LS	**Liner Sample**	Standard Penetration Test driving a 2.0-inch outside diameter split spoon equipped with two 3-inch long, 3/8-inch inside diameter brass liners, separated by a 1-inch long spacer, into undisturbed soil by the same means of the Spoon Sample.
ST	**Shelby Tube**	A 3.0-inch outside diameter thin-walled tube continuously pushed into the undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).
--	**Continuous Penetration Resistance**	Driving a 2.0-inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same means of the spoon sample. The blows for each successive 12-inch increment are recorded.

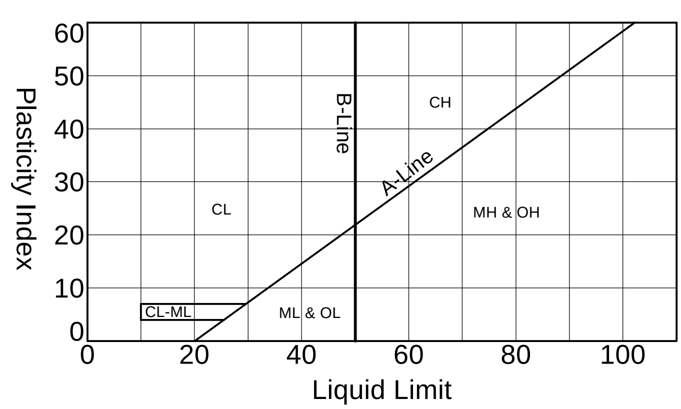
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	2 - 4	0.25 - 0.5	Loose	5 - 10
Firm	5 - 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9 - 15	1 - 2	Dense	31 - 50
Very Stiff	16 - 30	2 - 4	Very Dense	> 50
Hard	> 30	> 4		

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL OR MODIFIED SYMBOLS MAY BE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS OR TO PROVIDE A BETTER GRAPHICAL PRESENTATION OF THE SOIL

MATERIAL SIZE	PARTICLE SIZE			
	Lower Limit		Upper Limit	
	mm	Sieve Size ◆	mm	Sieve Size ◆
SANDS				
Fine	0.075	#200	0.42	#40
Medium	0.420	#40	2.00	#10
Coarse	2.000	#10	4.75	#4
GRAVELS				
Fine	4.75	#4	19	0.75" ×
Coarse	19	0.75" ×	75	3" ×
COBBLES	75	3" ×	300	12" ×
BOULDERS	300	12" ×	900	36" ×

◆U.S. Standard ×Clear Square Openings



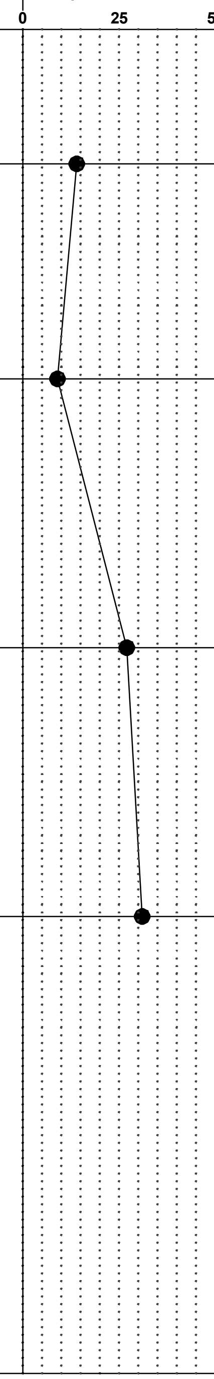
Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Visual Classification

Depth (feet)	Visual Classification
0 – 0.3	Grass/Topsoil
0.3 – 3.0	Dense Brown CLAYEY SAND (SC-Dry to Moist) with Gravel
3.0 – 6.0	Stiff Brown SANDY LEAN CLAY (CL-Dry to Moist)
6.0 – 15.0	Loose Brown SILTY SAND (SM-Dry to Moist)
	Dense, Some Gravel
	With Gravel
15.0 – 17.0	Dense Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 1-10% Cobble
	5-15% Cobble
17.0	Auger Refusal on Cobbles

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
S-1	2.5	NT	NT
S-2	6.5	NT	NT
S-3	11.5	NT	NT
S-4	16.5	NT	NT

Penetration Resistance Blows per Foot



Boring Date: **9-6-18**
Field Engineer/Technician: **J. Miller**
Driller: **Oscar**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 1**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

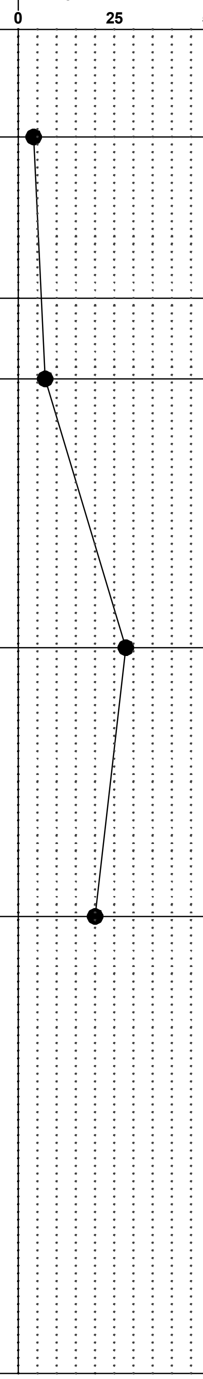
Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Visual Classification

Depth (feet)	Visual Classification
0 – 0.3	Grass/Topsoil
0.3 – 5.0	Soft Brown LEAN CLAY with SAND (CL-Dry to Moist)
5.0 – 17.0	Loose Brown SILTY SAND (SM-Dry to Moist) with Trace Clay, Trace Gravel
	Dense, No Clay, Some Gravel
	Medium Dense
17.0 – 18.0	Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 5-10% Cobble
18.0	Auger Refusal on Cobbles

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
RS-1	2.0	NT	NT
BS-2	5.0	NT	NT
S-3	6.5	NT	NT
S-4	11.5	NT	NT
S-5	16.5	NT	NT

Penetration Resistance Blows per Foot



Boring Date: **9-6-18**
Field Engineer/Technician: **J. Miller**
Driller: **Oscar**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 2**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

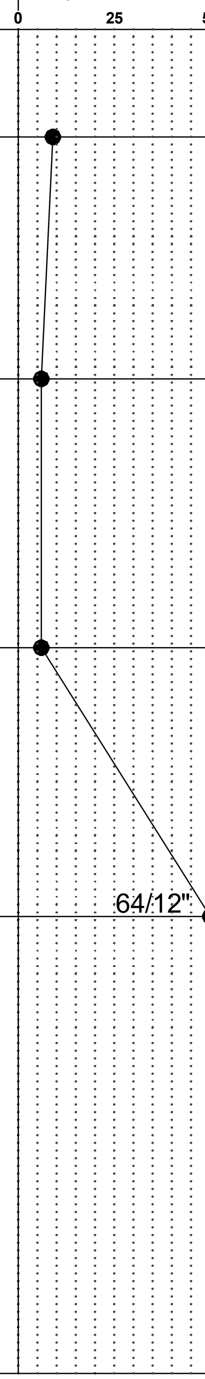
Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Rig Type:	CME-75
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**N/A**

Visual Classification

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0 – 0.3	Grass/Topsoil					
0.3 – 3.0	Stiff Brown SANDY LEAN CLAY (CL-Dry to Moist) with Little Gravel	RS-1	2.0	19.7	105.4	
3.0 – 14.0	Loose Brown SILTY, CLAYEY SAND (SC/SM-Dry) with Trace Gravel	S-2	6.5	NT	NT	
	Loose	S-3	11.5	NT	NT	
14.0 – 16.0	Very Dense Brown POORLY GRADED SAND with SILT (SP/SM-Dry) with Gravel					
16.0 – 17.0	Brown SILTY GRAVEL with SAND (GM-Dry) with 5-15% Cobble	S-4	16.5	NT	NT	64/12"
17.0	Auger Refusal on Cobbles					



Boring Date:	**9-6-18**
Field Engineer/Technician:	**J. Miller**
Driller:	**Oscar**
Contractor:	**Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 3**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

Depth (feet)	Graphic Log	Rig Type: CME-75 Boring Type: Hollow Stem Auger Surface Elevation: N/A Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Grass/Topsoil	0.3					
		Dense Brown CLAYEY SAND (SC-Dry to Moist) with Little Gravel	2.0					
		Very Dense Light Brown SILTY GRAVEL with SAND (GM-Dry) with 5-15% Cobble	3.0	S-1	2.5	NT	NT	●
		Auger Refusal on Cobbles						
5								
10								
15								
20								
25								

Boring Date: **9-6-18**
Field Engineer/Technician: **J. Miller**
Driller: **Oscar**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 4**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

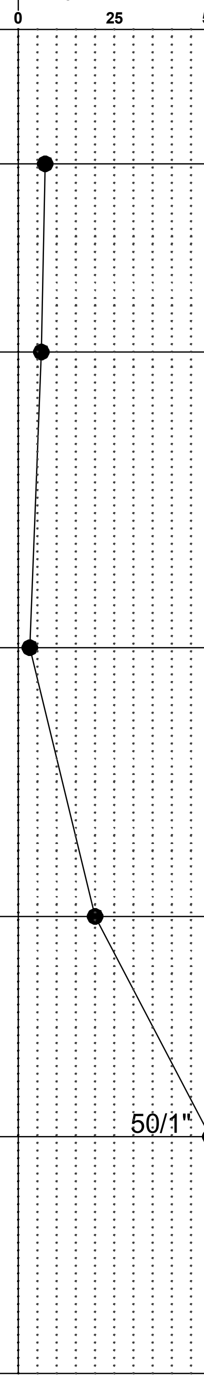
Mesa, Arizona

Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Rig Type:	CME-75
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**N/A**

Depth (feet)	Visual Classification	Layer Depth	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0	Grass/Topsoil	0.3					
	Loose Brown CLAYEY SAND (SC-Dry to Moist) with Trace Gravel		S-1	2.5	NT	NT	
5			RS-2	6.0	NT	NT	
10	Very Loose, Moist		S-3	11.5	NT	NT	
		13.0					
15	Medium Dense Brown POORLY GRADED SAND with SILT (SP/SM-Dry to Moist) with Little Gravel						
	with Gravel		S-4	16.5	NT	NT	
		18.0					
20	Very Dense Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 1-10% Cobble						
	5-15% Cobble		S-5	20.6	NT	NT	50/1"
		21.0					
	Auger Refusal on Cobbles						
25							



Boring Date:	**9-6-18**
Field Engineer/Technician:	**J. Miller**
Driller:	**Oscar**
Contractor:	**Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 5**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0 – 0.3	Grass/Topsoil					
0.3 – 5.0	FILL: Medium Dense Brown CLAYEY SAND (SC-Dry to Moist) with Trace Gravel	S-1	2.5	NT	NT	
5.0 – 10.0	FILL: Medium Dense Brown SILTY SAND (SM-Dry to Moist) with Some Gravel	S-2	6.5	NT	NT	
10.0 – 14.0	FILL: Very Soft Dark Brown LEAN CLAY with SAND (CL-Moist) with trace glass and debris	S-3	11.5	NT	NT	
14.0 – 15.0	Very Dense Brown SILTY SAND (SM-Dry to Moist) with Gravel					
15.0 – 16.0	Very Dense Brown SILTY GRAVEL with SAND (GM-Dry) with 5-15% Cobble	S-4	16.5	NT	NT	68/12"
16.0	Auger Refusal on Cobbles					

Depth scale: 0, 5, 10, 15, 20, 25

Boring Date: **9-6-18**
Field Engineer/Technician: **J. Miller**
Driller: **Oscar**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 6**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

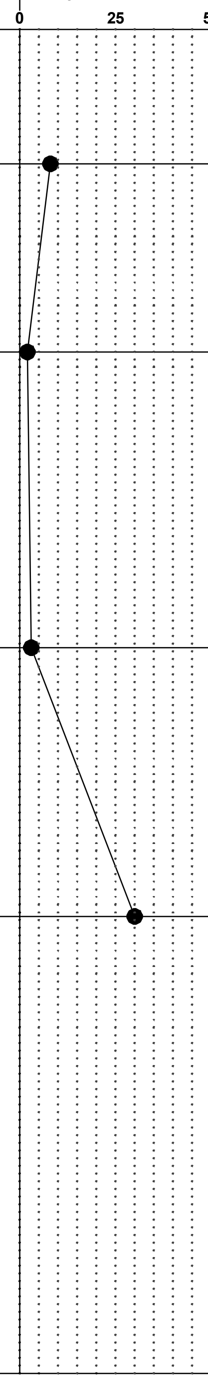
Rig Type:	**CME-75**
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**N/A**

Visual Classification

Depth (feet)	Visual Classification
0 – 0.3	Grass/Topsoil
0.3 – 5.0	Loose Brown SANDY LEAN CLAY (CL-Dry to Moist)
5.0 – 14.0	Very Soft Brown LEAN CLAY (CL-Moist)
14.0 – 16.0	Dense Brown POORLY GRADED SAND with SILT (SP/SM-Dry to Moist) with Gravel
16.0 – 18.0	Very Dense Brown SILTY GRAVEL with SAND (GM-Dry) with 5-15% Cobble
18.0	Auger Refusal on Cobbles

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
S-1	2.5	NT	NT
RS-2	6.0	17.3	93.4
S-3	11.5	NT	NT
S-4	16.5	NT	NT

Penetration Resistance Blows per Foot



Boring Date:	**9-6-18**
Field Engineer/Technician:	**J. Miller**
Driller:	**Oscar**
Contractor:	**Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 7**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

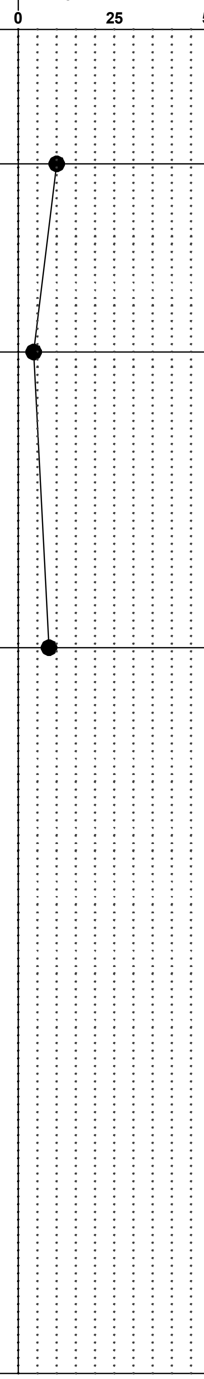
Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Rig Type:	**CME-75**
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0 – 1.0	Grass/Topsoil/Pea Gravel				
1.0 – 3.0	Stiff Brown SANDY LEAN CLAY (CL-Dry to Moist)	S-1	2.5	NT	NT
3.0 – 8.0	Very Loose Brown CLAYEY SAND (SC-Dry to Moist) with Trace Gravel	RS-2	6.0	NT	NT
8.0 – 12.0	Loose Brown POORLY GRADED SAND with SILT (SP/SM-Dry to Moist) with Trace Gravel	S-3	11.5	NT	NT
12.0 – 13.0	Very Dense Brown SILTY GRAVEL with SAND (GM-Dry) with 5-15% Cobble				
13.0	Auger Refusal on Cobbles				

Penetration Resistance Blows per Foot



Boring Date:	**9-6-18**
Field Engineer/Technician:	**J. Miller**
Driller:	**Oscar**
Contractor:	**Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 8**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

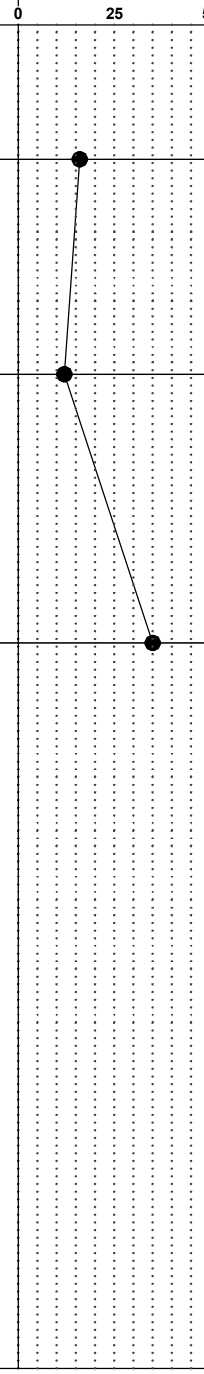
Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Rig Type:	CME-75
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**N/A**

Depth (feet)	Visual Classification	Strata Depth	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	Grass/Topsoil	0.3				
	Medium Dense Brown <u>CLAYEY SAND</u> (SC-Dry to Moist) with Trace Gravel		S-1	2.5	NT	NT
5		6.0				
	Medium Dense Brown <u>SILTY SAND</u> (SM-Dry to Moist) with Little Gravel		S-2	6.5	NT	NT
	with Gravel, 1 to 10% Cobble					
10	Dense Light Brown <u>SILTY GRAVEL with SAND</u> (GM-Dry to Moist) with 5-15% Cobble	10.0				
	Auger Refusal on Cobbles	11.0	S-3	11.5	NT	NT
15						
20						
25						

Penetration Resistance Blows per Foot



Boring Date:	**9-6-18**
Field Engineer/Technician:	**J. Miller**
Driller:	**Oscar**
Contractor:	**Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 9**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

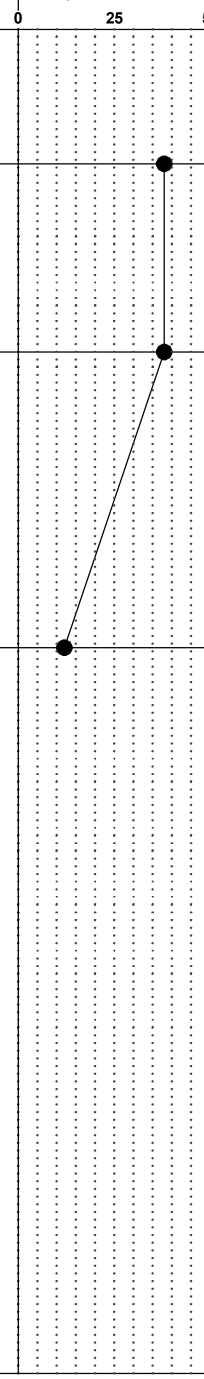
Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Rig Type:	CME-75
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**N/A**

Depth (feet)	Visual Classification	Depth to stratum change	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	3" Asphalt Concrete	0.3				
	FILL: Brown SILTY SAND (SM-Dry) with Gravel	0.9				
	Dense Brown SILTY SAND (SM-Dry to Moist) with Gravel, 1-10% Cobble		S-1	2.5	NT	NT
5			RS-2	6.0	7.0	102.3
10	Medium Dense	11.0				
	Dense Brown SILTY GRAVEL with SAND (GM-Dry) with 5-15% Cobble		S-3	11.5	NT	NT
		13.0				
	Auger Refusal on Cobbles					
15						
20						
25						

Penetration Resistance Blows per Foot



Boring Date:	**9-7-18**
Field Engineer/Technician:	**J. Miller**
Driller:	**F. Esparza**
Contractor:	**Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-10**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Depth (feet)	Graphic Log	Rig Type: CME-75 Boring Type: Hollow Stem Auger Surface Elevation: N/A Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		3" Asphalt Concrete	0.3					
		FILL: Brown SILTY SAND (SM-Dry) with Gravel,1-10% Cobble	0.8					
		Dense Brown SILTY SAND (SM-Dry to Moist) with Gravel, 1-10% Cobble		S-1	2.5	NT	NT	●
			4.0					
		Auger Refusal on Cobbles						
5								
10								
15								
20								
25								

Boring Date: **9-7-18**
Field Engineer/Technician: **J. Miller**
Driller: **F. Esparza**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-11**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

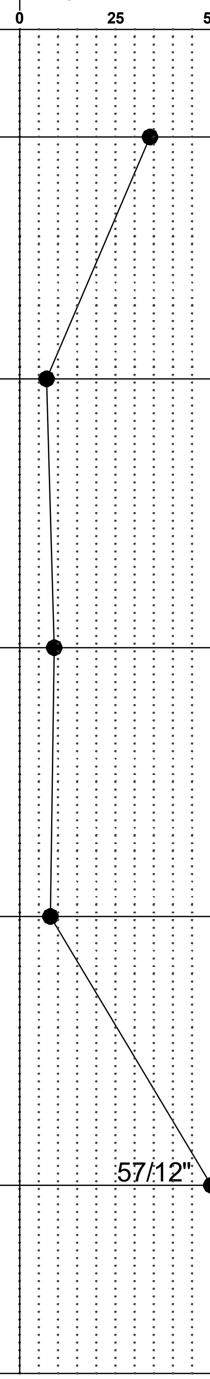
Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Depth of change
0	Grass/Topsoil	0.3
	FILL: Dense Brown CLAYEY SAND (SC-Dry to Moist) with Some Gravel	
	With Gravel, 1 to 10% Cobble	
5	Loose, Dark Brown, Little Gravel, No Cobble	
	Trace Glass & Debris	
10		
15	Loose Brown SILTY SAND (SM-Dry to Moist) with Little Gravel	15.0
	Very Dense Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 5-15% Cobble	18.0
20		
	Auger Refusal on Cobbles	23.0
25		

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
RS-1	2.0	NT	NT	
S-2	6.5	NT	NT	
S-3	11.5	NT	NT	
S-4	16.5	NT	NT	
S-5	21.5	NT	NT	57/12"



Boring Date: **9-7-18**
Field Engineer/Technician: **J. Miller**
Driller: **F. Esparza**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-12**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Depth (feet)	Graphic Log	Rig Type: CME-75 Boring Type: Hollow Stem Auger Surface Elevation: N/A Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Grass/Topsoil	0.3					
		Possible Fill: Medium Dense Brown CLAYEY SAND (SC-Dry to Moist) with Trace Gravel		S-1	2.0	NT	NT	
		1 to 10% Cobble	4.0					
		Auger Refusal on Cobbles						
5								
10								
15								
20								
25								

Boring Date: **9-7-18**
Field Engineer/Technician: **J. Miller**
Driller: **F. Esparza**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-13**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

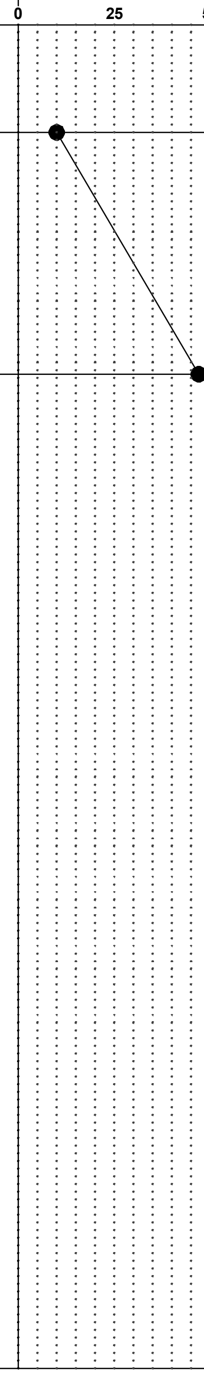
Mesa, Arizona

Project No.: **181744SA**

Rig Type:	**CME-75**
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0 – 0.5	Grass/Topsoil				
0.5 – 4.0	FILL: Loose Brown <u>SILTY SAND</u> (SM-Dry to Moist) with Trace Glass, Debris	RS-1	2.0	12.4	102.8
4.0 – 6.5	Dense Brown <u>SILTY GRAVEL with SAND</u> (GM-Dry to Moist) with 1-10% Cobble	S-2	6.5	NT	NT
6.5	Auger Refusal on Cobbles				

Penetration Resistance Blows per Foot



Boring Date:	**9-7-18**
Field Engineer/Technician:	**J. Miller**
Driller:	**F. Esparza**
Contractor:	**Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-14**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Depth (feet)	Graphic Log	Rig Type: CME-75 Boring Type: Hollow Stem Auger Surface Elevation: N/A Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Grass/Topsoil 0.5					
		FILL: Medium Dense Brown SILTY SAND (SM-Dry to Moist) with Trace Gravel, Trace Glass, Debris	S-1	2.5	NT	NT	
		Some Clay 4.0					
5		Very Dense Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 5-15% Cobble	S-2	6.5	NT	NT	87/8"
		----- 8.0 Auger Refusal on Cobbles					
10							
15							
20							
25							

Boring Date: **9-7-18**
Field Engineer/Technician: **J. Miller**
Driller: **F. Esparza**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-15**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Rig Type:	CME-75
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**N/A**

Depth (feet) | Graphic Log

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0 – 0.3	Grass/Topsoil					
0.3 – 5.0	Loose Brown SILTY SAND (SM-Dry to Moist) with Trace Clay, Trace Gravel	S-1	2.5	NT	NT	
5.0 – 8.0	Dense Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 1-15% Cobble	S-2	6.5	NT	NT	
8.0	Auger Refusal on Cobbles					

0 5 10 15 20 25

Boring Date:	**9-10-18**
Field Engineer/Technician:	**J. Miller**
Driller:	**R. Quezada**
Contractor:	**Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-16**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

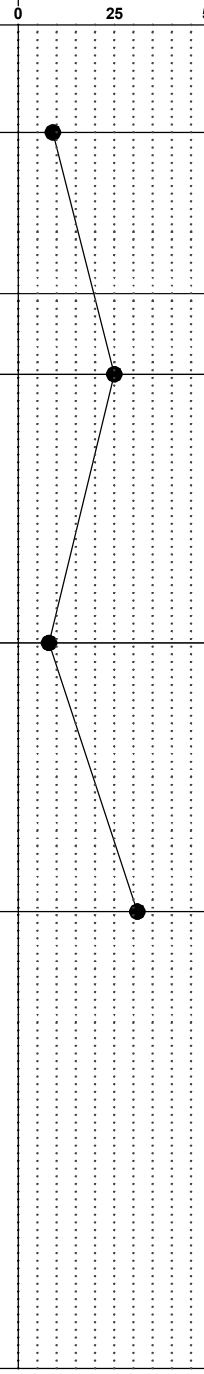
Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Rig Type:	**CME-75**
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0 – 0.3	Grass/Topsoil				
0.3 – 5.0	Loose Brown SILTY SAND (SM-Dry to Moist)	RS-1	2.0	6.3	90.6
		BS-2	5.0	NT	NT
5.0 – 9.0	Medium Dense Brown SILTY, CLAYEY SAND (SC/SM-Dry to Moist) with Gravel	S-3	6.5	NT	NT
9.0 – 15.0	Loose Brown POORLY GRADED SAND (SP-Dry to Moist) with Trace Gravel	S-4	11.5	NT	NT
15.0 – 17.0	Dense Light Brown POORLY GRADED SAND with SILT (SP/SM-Dry to Moist) with Some Gravel, 1-10% Cobble	S-5	16.5	NT	NT
17.0 – 18.0	Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 5-15% Cobble				
18.0	Auger Refusal on Cobbles				

Penetration Resistance Blows per Foot



Boring Date:	**9-10-18**
Field Engineer/Technician:	**J. Miller**
Driller:	**R. Quezada**
Contractor:	**Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-17**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

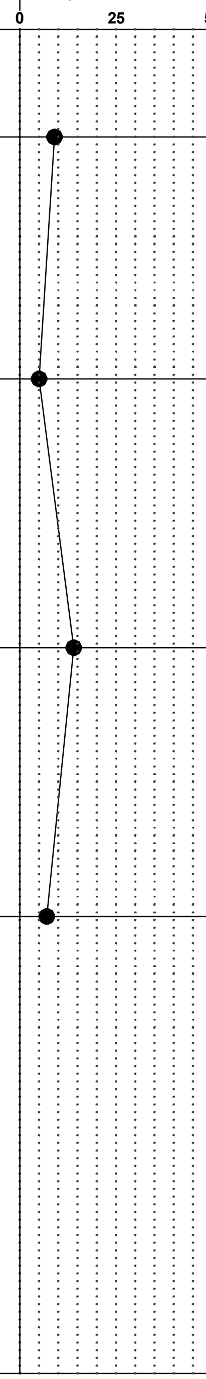
Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Rig Type:	**CME-75**
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	Grass/Topsoil				
0.3	Stiff Brown SANDY LEAN CLAY (CL-Moist)	RS-1	2.0	NT	NT
3.0	Loose Brown SILTY SAND (SM-Dry to Moist)	S-2	6.5	NT	NT
10.0	Medium Dense Brown SILTY SAND (SM-Dry to Moist) with Gravel	S-3	11.5	NT	NT
13.0	Loose Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 1-10 % Cobble				
	5-15% Cobble	S-4	16.5	NT	NT
18.0	Auger Refusal on Cobbles				

Penetration Resistance Blows per Foot



Boring Date:	**9-10-18**
Field Engineer/Technician:	**J. Miller**
Driller:	**R. Quezada**
Contractor:	**Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-18**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Visual Classification

Depth (feet)	Visual Classification
0.3	Grass/Topsoil
5.0	Firm Brown SANDY LEAN CLAY (CL-Moist)
9.0	Soft Brown SANDY SILT (ML-Dry to Moist) with Trace Clay
11.0	Medium Dense Light Brown SILTY SAND (SM-Dry) with Gravel
14.0	Dense Brown SILTY GRAVEL with SAND (GM-Dry) with 1-10% Cobble; 5-15% Cobble
	Auger Refusal on Cobbles

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0–25–50)
S-1	2.5	NT	NT	
S-2	6.5	NT	NT	
S-3	11.5	NT	NT	

Boring Date: **9-10-18**
Field Engineer/Technician: **J. Miller**
Driller: **R. Quezada**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-19**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

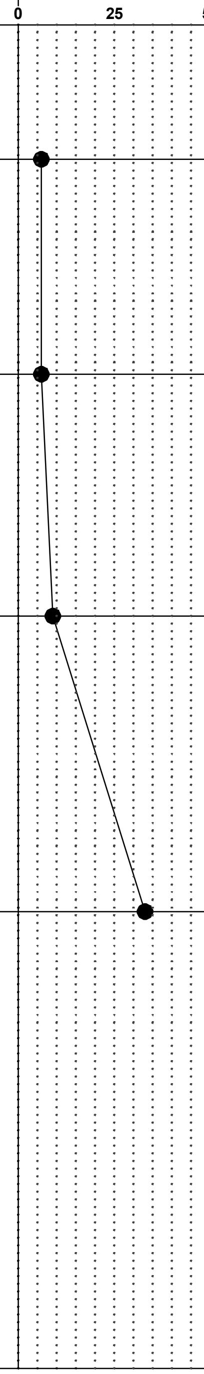
Mesa, Arizona

Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Depth (feet)	Visual Classification	Strata Depth	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0	Grass/Topsoil	0.3					
	Loose Brown CLAYEY SAND (SC-Dry to Moist)	3.0	S-1	2.5	NT	NT	
5	Loose Brown SILTY SAND (SM-Dry)	15.0	S-2	6.5	NT	NT	
10			S-3	11.0	NT	NT	
15	Dense Brown SILTY GRAVEL with SAND (GM-Dry) with 5-15% Cobble	17.0	S-4	16.5	NT	NT	
	Auger Refusal on Cobbles						
20							
25							

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Boring Date: **9-10-18**
Field Engineer/Technician: **J. Miller**
Driller: **R. Quezada**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-20**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

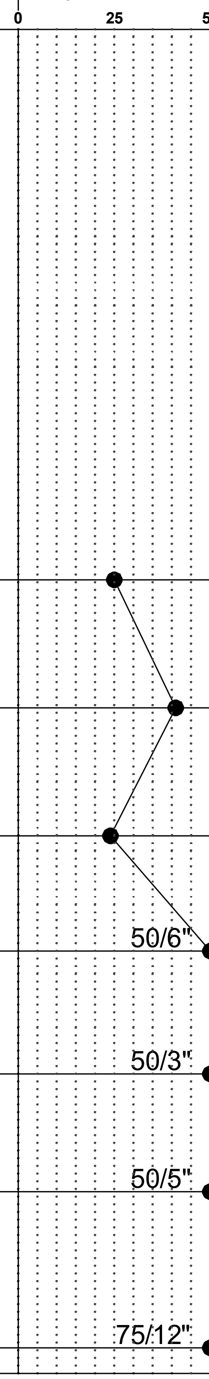
Rig Type:	**CME-75**
Boring Type:	**TUBEX**
Surface Elevation:	**N/A**

Visual Classification

Depth (feet)	Visual Classification
0.3	Grass/Topsoil
3.0	Loose Brown CLAYEY SAND (SC-Dry to Moist)
15.0	Loose Brown SILTY SAND (SM-Dry)
20.0	Dense Brown SILTY GRAVEL with SAND (GM-Dry) with 5-15% Cobble
23.0	Medium Dense Brown POORLY GRADED SAND with SILT (SP/SM-Dry to Moist) with Trace Gravel
28.0	Dense Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 5-15% Cobble
33.0	Medium Dense Brown POORLY GRADED SAND with SILT (SP/SM-Dry to Moist) with Trace Gravel
38.0	Very Dense Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 1-10% Cobble
47.0	Very Dense Brown POORLY GRADED GRAVEL with SAND (GP-Dry to Moist) with 5-15% Cobble; Brown/Gray
51.5	Very Dense Brown SILTY GRAVEL with SAND (GM-Moist) with 5-15% Cobble, Trace Clay

End of Boring

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
S-1	21.5	NT	NT	
S-2	26.5	NT	NT	
S-3	31.5	NT	NT	
S-4	36.0	NT	NT	50/6"
S-5	40.8	NT	NT	50/3"
S-6	45.4	NT	NT	50/5"
S-7	51.5	NT	NT	75/12"



Boring Date:	**9-10-18**
Field Engineer/Technician:	**J. Miller**
Driller:	**R. Quezada**
Contractor:	**Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **T- 1**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Rig Type: **CME-75**
Boring Type: **TUBEX**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0 – 0.3	Grass/Topsoil					
0.3 – 5.0	FILL: Medium Dense Brown <u>CLAYEY SAND</u> (SC-Dry to Moist) with Trace Gravel					
5.0 – 10.0	FILL: Medium Dense Brown <u>SILTY SAND</u> (SM-Dry to Moist) with Some Gravel					
10.0 – 14.0	FILL: Very Soft Dark Brown <u>LEAN CLAY with SAND</u> (CL-Moist) with Trace glass, Debris					
14.0 – 17.0	Very Dense Brown <u>SILTY SAND</u> (SM-Dry to Moist) with Gravel, 1-10% Cobble					
17.0 – 50.3	Very Dense Brown <u>SILTY GRAVEL with SAND</u> (GM-Dry to Moist) with 5-15% Cobble	S-1	21.3	NT	NT	78/9"
	1-10% Cobble	S-2	26.5	NT	NT	69/12"
	5-15% Cobble	S-3	31.0	NT	NT	50/6"
		S-4	36.3	NT	NT	86/9"
	Moist	S-5	40.7	NT	NT	50/2"
	Wet	S-6	45.4	NT	NT	50/5"
50.3	10-20% Cobble, Some Clay	S-7	50.3	NT	NT	50/3"
	End of Boring					

Boring Date: **9-10-18**
Field Engineer/Technician: **J. Miller**
Driller: **R. Quezada**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **T- 2**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

Depth (feet)	Rig Type: CME-75 Boring Type: TUBEX Surface Elevation: N/A Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0–25–50)
0	Grass/Topsoil	0.3					
	FILL: Dense Brown CLAYEY SAND (SC-Dry to Moist) with Some Gravel 1-10% Cobble						
5	Loose, Dark Brown, Little Gravel, No Cobble						
10	Trace Glass & Debris	15.0					
15	Loose Brown SILTY SAND (SM-Dry to Moist) with Little Gravel	18.0					
20	Very Dense Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 5-15% Cobble						
25			S-1	25.9	NT	NT	50/5"
30	1-10% Cobble	32.0	S-2	31.5	NT	NT	
35	Very Dense Brown POORLY GRADED GRAVEL with SAND (GP-Dry to Moist) with 5-15% Cobble		S-3	36.3	NT	NT	89/10"
40	Moist	42.0	S-4	41.0	NT	NT	50/6"
45	Very Dense Brown CLAYEY GRAVEL with SAND (GC-Moist) with 5-15% Cobble	48.0	S-5	46.4	NT	NT	78/11"
50	Very Dense Brown SILTY GRAVEL with SAND (GM-Wet) with 5-15% Cobble, Trace Clay	50.8	S-6	50.8	NT	NT	50/4"
	End of Boring						

Boring Date: **9-10-18**
Field Engineer/Technician: **J. Miller**
Driller: **R. Quezada**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **T- 3**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

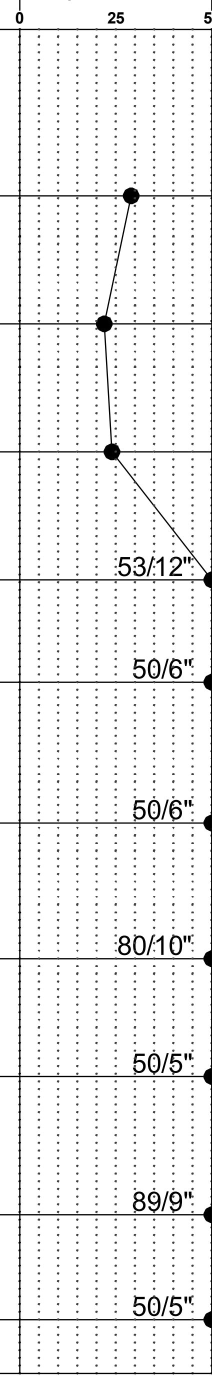
Project No.: **181744SA**

Rig Type:	CME-75
Boring Type:	TUBEX
Surface Elevation:	N/A

Visual Classification

Depth (feet)	Visual Classification
0.3	Grass/Topsoil
3.0	Dense Brown CLAYEY SAND (SC-Dry to Moist) with Little Gravel 1-10% Cobble
9.0	Medium Dense Brown SILTY SAND (SM-Dry to Moist) with Trace Gravel
12.0	Medium Dense Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 1-10% Cobble
17.0	Medium Dense Brown SILTY SAND (SM-Dry to Moist) with Gravel
50.4	Very Dense Brown SILTY GRAVEL with SAND (GM-Dry to Moist) with 5-15% Cobble
	End of Boring

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
S-1	6.5	NT	NT	
S-2	11.5	NT	NT	
S-3	16.5	NT	NT	
S-4	21.5	NT	NT	53/12"
S-5	25.5	NT	NT	50/6"
S-6	31.0	NT	NT	50/6"
S-7	36.3	NT	NT	80/10"
S-8	40.9	NT	NT	50/5"
S-9	46.3	NT	NT	89/9"
S-10	50.4	NT	NT	50/5"



Boring Date:	9-10-18
Field Engineer/Technician:	J. Miller
Driller:	R. Quezada
Contractor:	Resilient Drilling

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **T- 4**

Union Office Complex - Mesa

NWC Cubs Way & Riverview Auto Drive

Mesa, Arizona

Project No.: **181744SA**

_SPEEDIE 181744SA.GPJ GENGEO.GDT 10/4/18

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
B- 2	BS-2	BULK	0.0 - 5.0	NT	NT	75.6	83	100	100	100	36	18	18	CL	LEAN CLAY with SAND
B- 2	RS-1	RING	1.0 - 2.0	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		
B- 3	RS-1	RING	1.0 - 2.0	19.7	105.4	58.7	80	86	88	100	36	18	18	CL	SANDY LEAN CLAY
B- 7	RS-2	RING	5.0 - 6.0	17.3	93.4	NT	NT	NT	NT	NT	NT	NT	NT		
B- 8	RS-2	RING	5.0 - 6.0	NT	NT	62.0	97	100	100	100	25	22	3	ML	SANDY SILT
B-10	RS-2	RING	5.0 - 6.0	7.0	102.3	8.3	26	36	38	100	NP	NP	NP	GP-GM	POORLY GRADED GRAVEL with SILT and SAND
B-17	BS-2	BULK	0.0 - 5.0	NT	NT	46.5	98	99	100	100	NP	NP	NP	SM	SILTY SAND
B-17	RS-1	RING	1.0 - 2.0	6.3	90.6	NT	NT	NT	NT	NT	NT	NT	NT		

Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

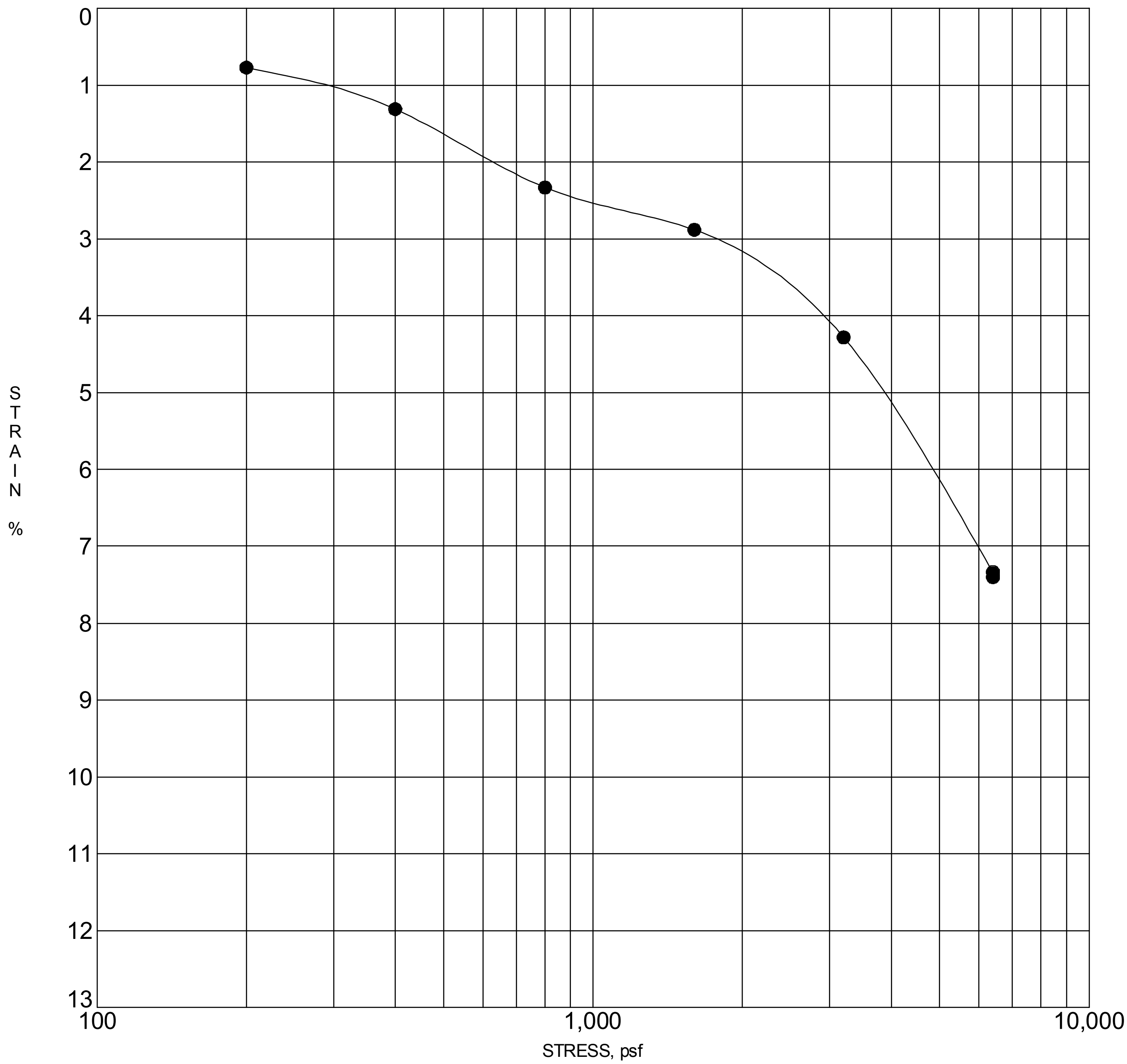
NT=Not Tested

Union Office Complex - Mesa
NWC Cubs Way & Riverview Auto Drive
Mesa, Arizona
Project No. 181744SA

SPEEDIE AND ASSOCIATES

CONSOLIDATION TEST

PROJECT: Union Office Complex - Mesa **PROJECT NO.:** 181744SA
LOCATION: NWC Cubs Way & Riverview Auto Drive **DATE:** 9/6/18
BORING NO.: B- 2 **SAMPLE NO.:** RS-1 **SAMPLE DEPTH:** 1 to 2 **LABORATORY NO.:**
LIQUID LIMIT: **PLASTIC LIMIT:** **PLASTICITY INDEX:**
CLASSIFICATION: **ASTM SOIL DESCRIPTION:**



Sample inundated at end of test at 6400 psf

SPEEDIE AND ASSOCIATES

CONSOLIDATION TEST

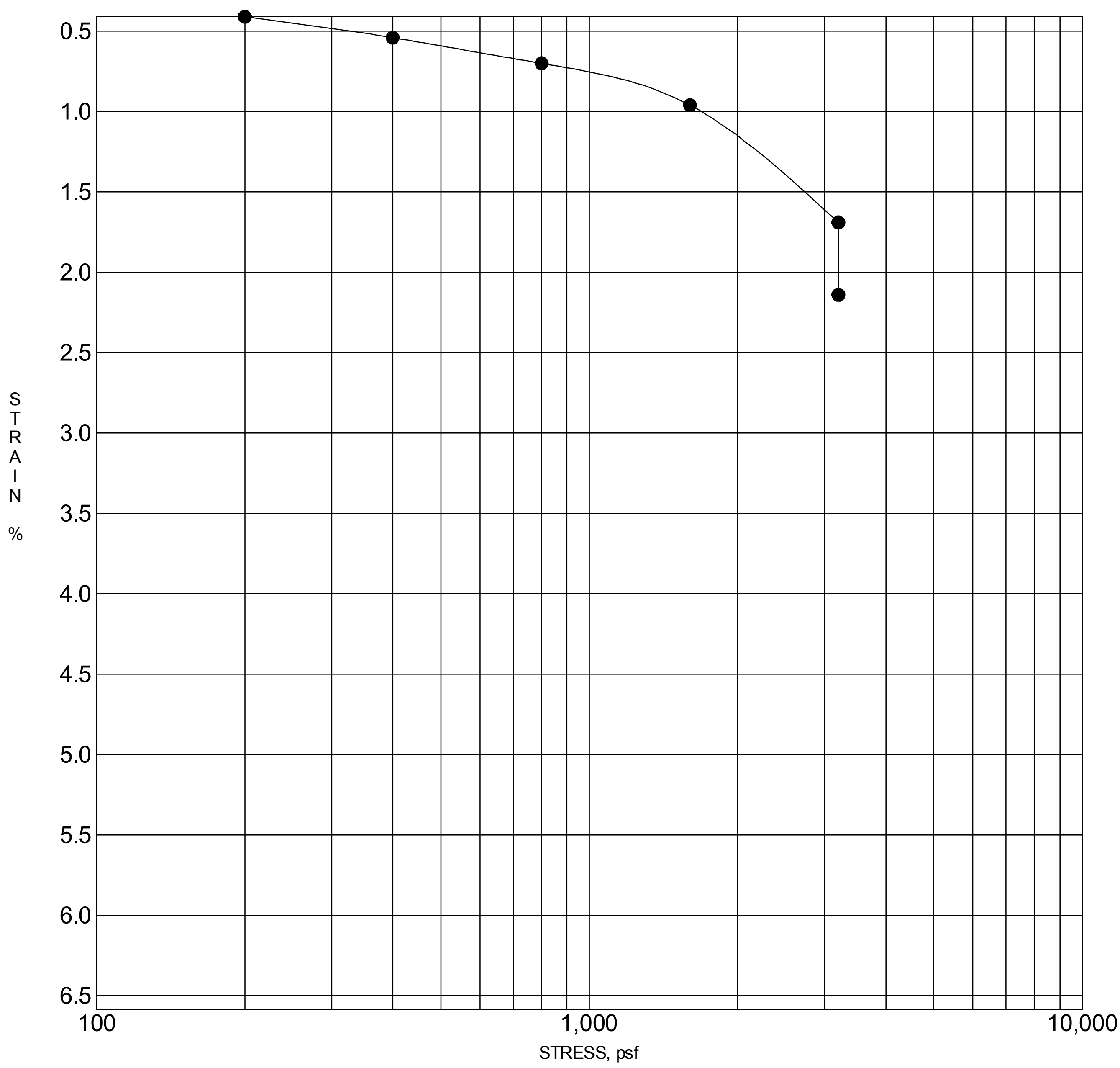
PROJECT: Union Office Complex - Mesa | PROJECT NO.: 181744SA

LOCATION: NWC Cubs Way & Riverview Auto Drive | DATE: 9/6/18

BORING NO.: B- 3 | SAMPLE NO.: RS-1 | SAMPLE DEPTH: 1 to 2 | LABORATORY NO.:

LIQUID LIMIT: 36 | PLASTIC LIMIT: 18 | PLASTICITY INDEX: 18

CLASSIFICATION: CL | ASTM SOIL DESCRIPTION: SANDY LEAN CLAY



Sample inundated at end of test at 3200 psf

SPEEDIE AND ASSOCIATES

CONSOLIDATION TEST

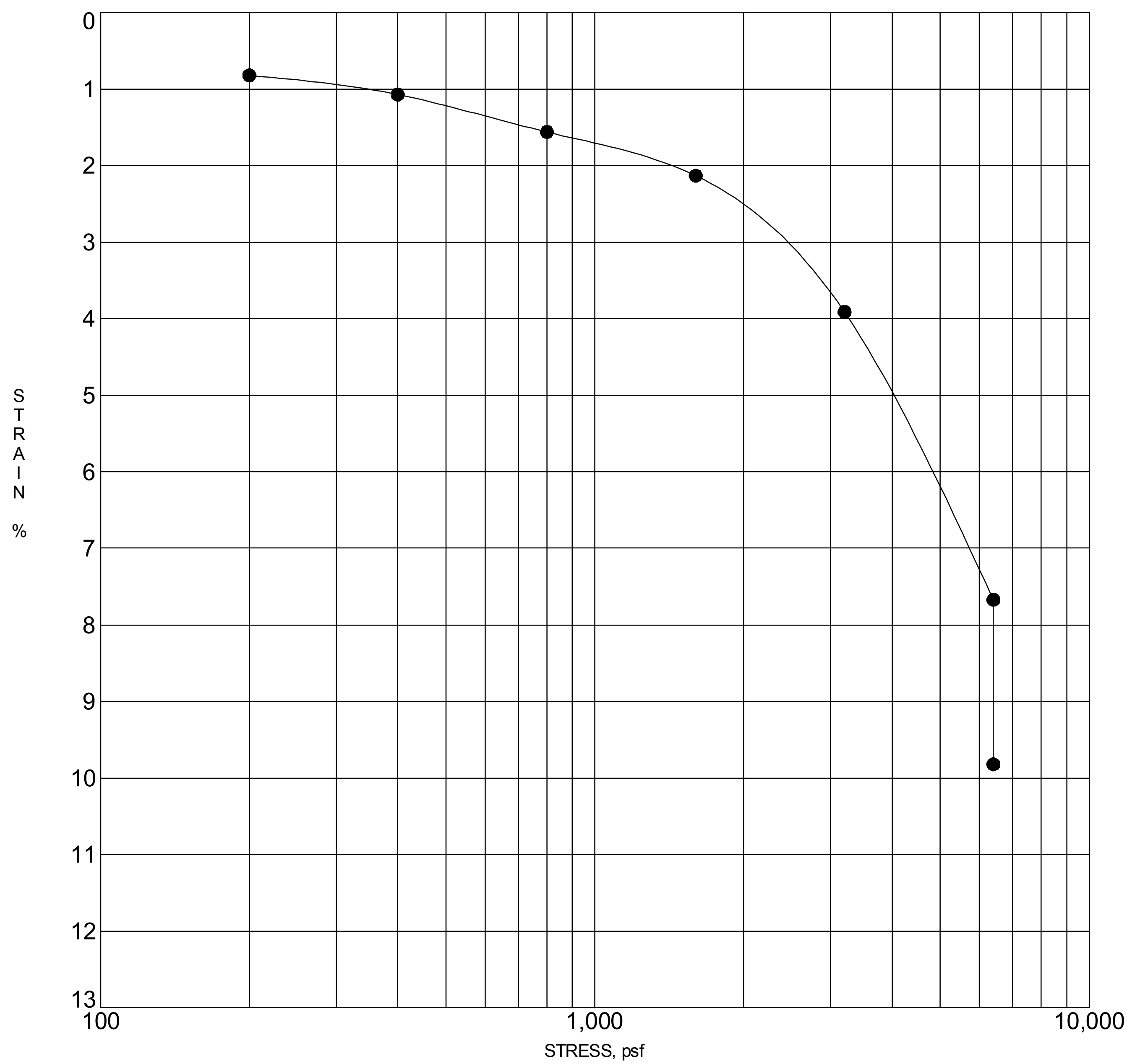
PROJECT: Union Office Complex - Mesa **PROJECT NO.:** 181744SA

LOCATION: NWC Cubs Way & Riverview Auto Drive **DATE:** 9/6/18

BORING NO.: B- 7 **SAMPLE NO.:** RS-2 **SAMPLE DEPTH:** 5 to 6 **LABORATORY NO.:**

LIQUID LIMIT: **PLASTIC LIMIT:** **PLASTICITY INDEX:**

CLASSIFICATION: **ASTM SOIL DESCRIPTION:**



Sample inundated at end of test at 6400 psf

SPEEDIE AND ASSOCIATES

GEOTECH CONSOLIDATION 181744SA.GPJ GENGEO.GDT 10/3/18

CONSOLIDATION TEST

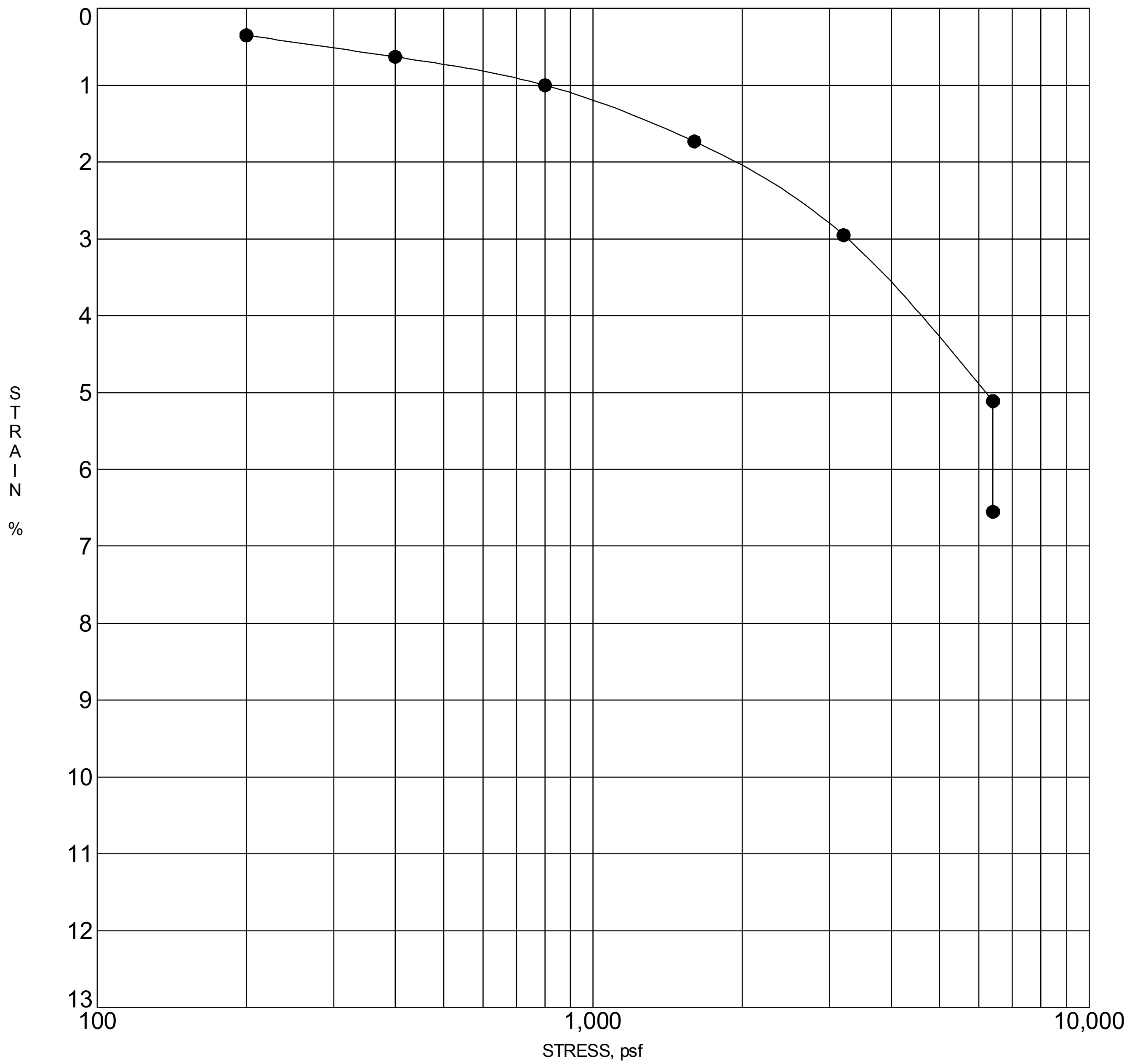
PROJECT: Union Office Complex - Mesa PROJECT NO.: 181744SA

LOCATION: NWC Cubs Way & Riverview Auto Drive DATE: 9/6/18

BORING NO.: B- 8 SAMPLE NO.: RS-2 SAMPLE DEPTH: 5 to 6 LABORATORY NO.:

LIQUID LIMIT: 25 PLASTIC LIMIT: 22 PLASTICITY INDEX: 3

CLASSIFICATION: ML ASTM SOIL DESCRIPTION: SANDY SILT



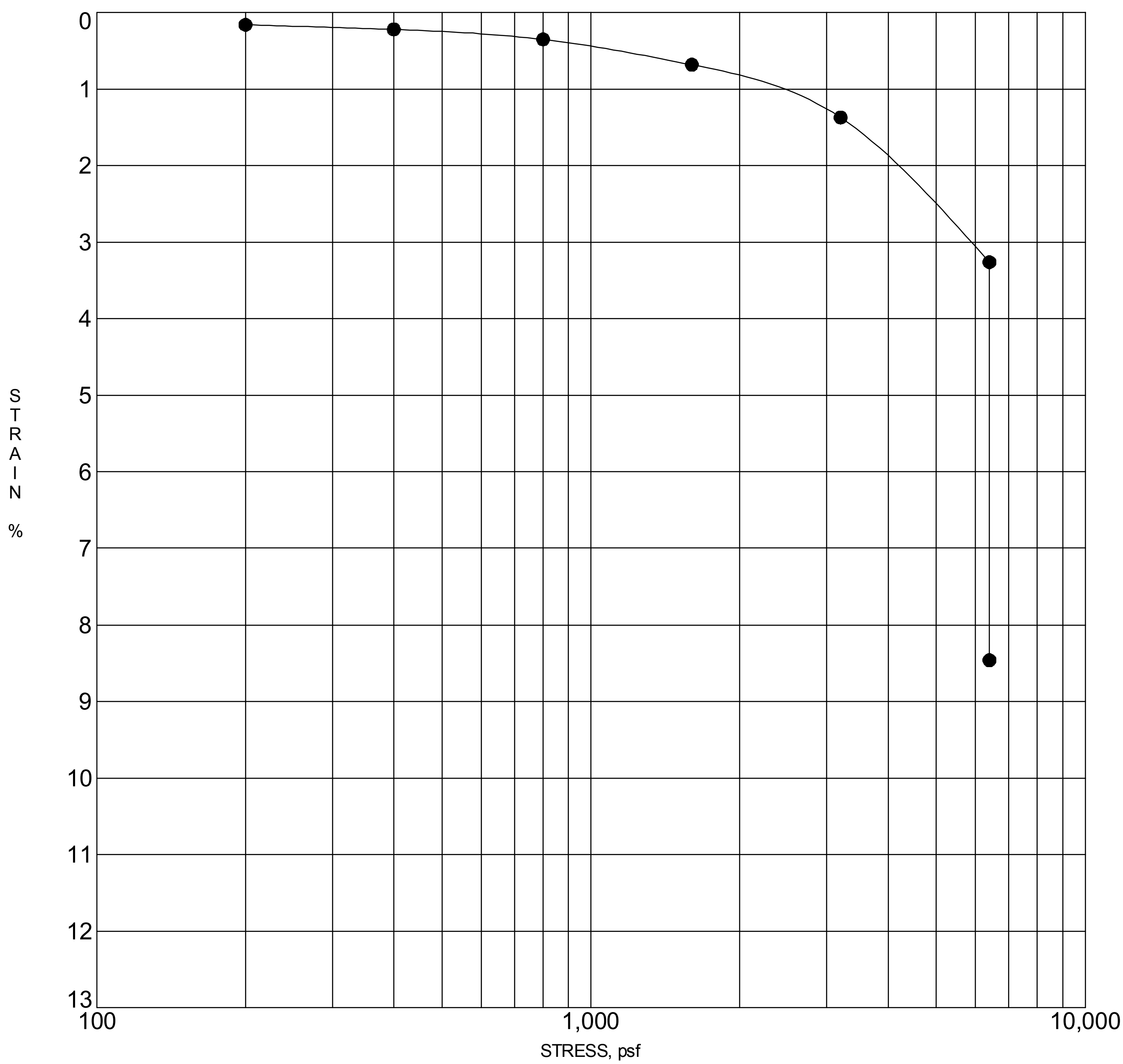
Sample inundated at end of test at 6400 psf

SPEEDIE AND ASSOCIATES

GEOTECH CONSOLIDATION 181744SA.GPJ GENGEO.GDT 10/3/18

CONSOLIDATION TEST

PROJECT:	Union Office Complex - Mesa			PROJECT NO.: 181744SA	
LOCATION:	NWC Cubs Way & Riverview Auto Drive			DATE: 9/7/18	
BORING NO.: B-10	SAMPLE NO.: RS-2	SAMPLE DEPTH: 5 to 6		LABORATORY NO.:	
LIQUID LIMIT:	NP	PLASTIC LIMIT:	NP	PLASTICITY INDEX:	NP
CLASSIFICATION:	GP-GM	ASTM SOIL DESCRIPTION:		POORLY GRADED GRAVEL with SILT and SAND	



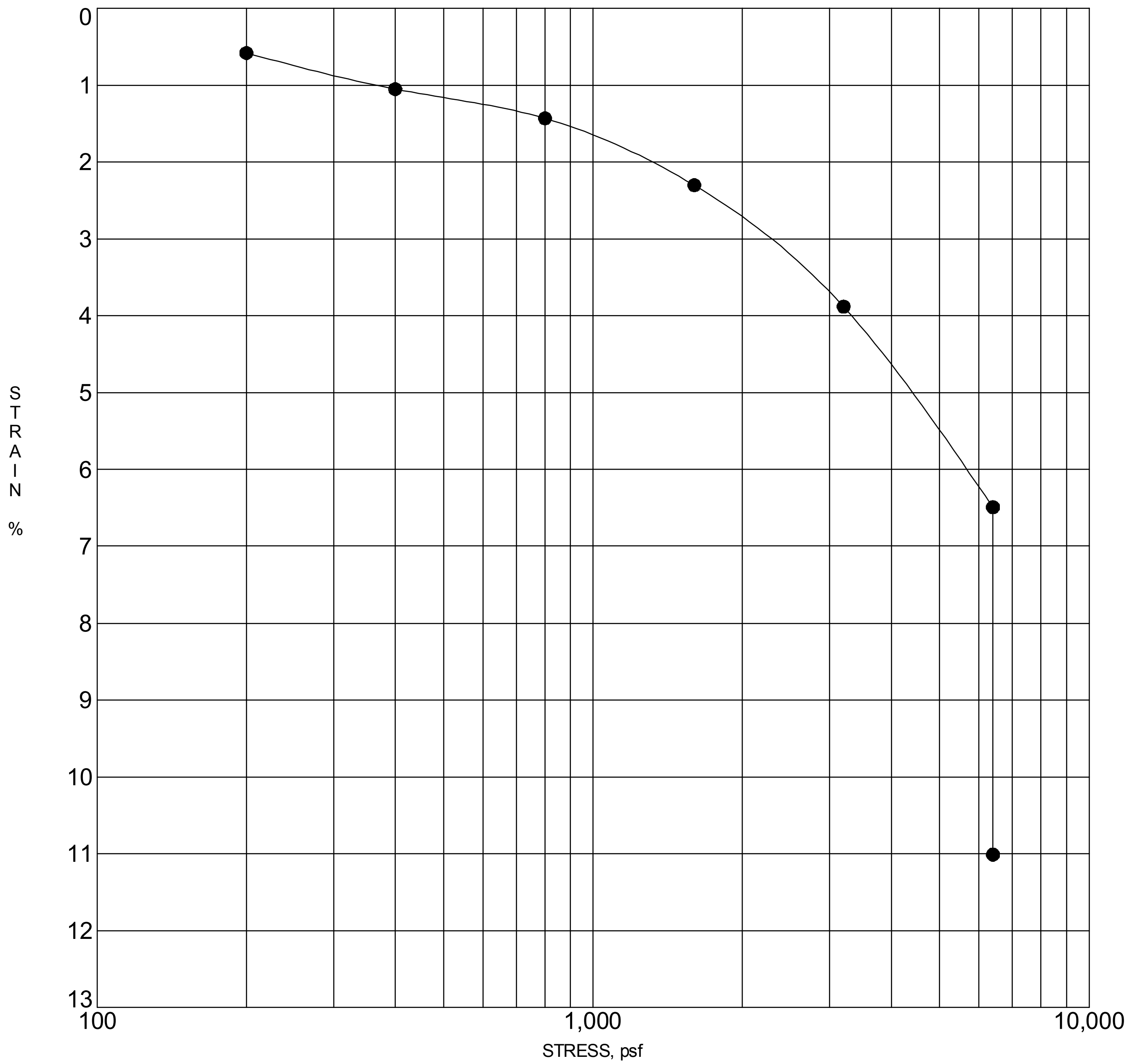
Sample inundated at end of test at 6400 psf

SPEEDIE AND ASSOCIATES

GEOTECH CONSOLIDATION 181744SA.GPJ GENGEO.GDT 10/3/18

CONSOLIDATION TEST

PROJECT:	Union Office Complex - Mesa				PROJECT NO.: 181744SA
LOCATION:	NWC Cubs Way & Riverview Auto Drive				DATE: 9/7/18
BORING NO.: B-14	SAMPLE NO.: RS-1	SAMPLE DEPTH: 1 to 2			LABORATORY NO.:
LIQUID LIMIT: 29		PLASTIC LIMIT: 18		PLASTICITY INDEX: 11	
CLASSIFICATION: SC		ASTM SOIL DESCRIPTION:	CLAYEY SAND		



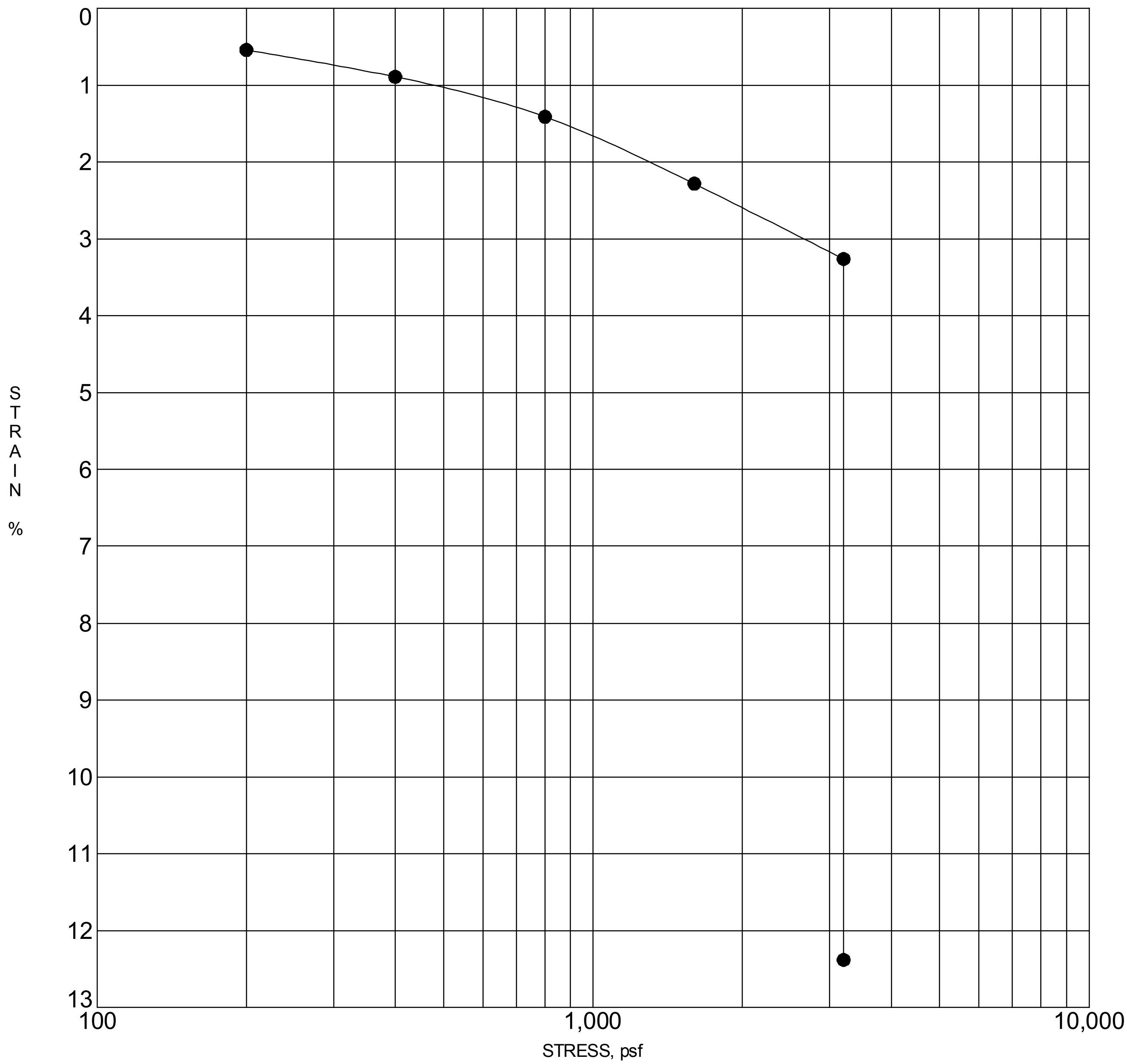
Sample inundated at end of test at 6400 psf

SPEEDIE AND ASSOCIATES

GEOTECH CONSOLIDATION 181744SA.GPJ GENGEO.GDT 10/3/18

CONSOLIDATION TEST

PROJECT: Union Office Complex - Mesa **PROJECT NO.:** 181744SA
LOCATION: NWC Cubs Way & Riverview Auto Drive **DATE:** 9/10/18
BORING NO.: B-17 **SAMPLE NO.:** RS-1 **SAMPLE DEPTH:** 1 to 2 **LABORATORY NO.:**
LIQUID LIMIT: **PLASTIC LIMIT:** **PLASTICITY INDEX:**
CLASSIFICATION: **ASTM SOIL DESCRIPTION:**



Sample inundated at end of test at 3200 psf

SPEEDIE AND ASSOCIATES

MOISTURE-DENSITY RELATIONS

PROJECT: Union Office Complex - Mesa PROJECT NO.: 181744SA

LOCATION: NWC Cubs Way & Riverview Auto Drive DATE: 9/6/18

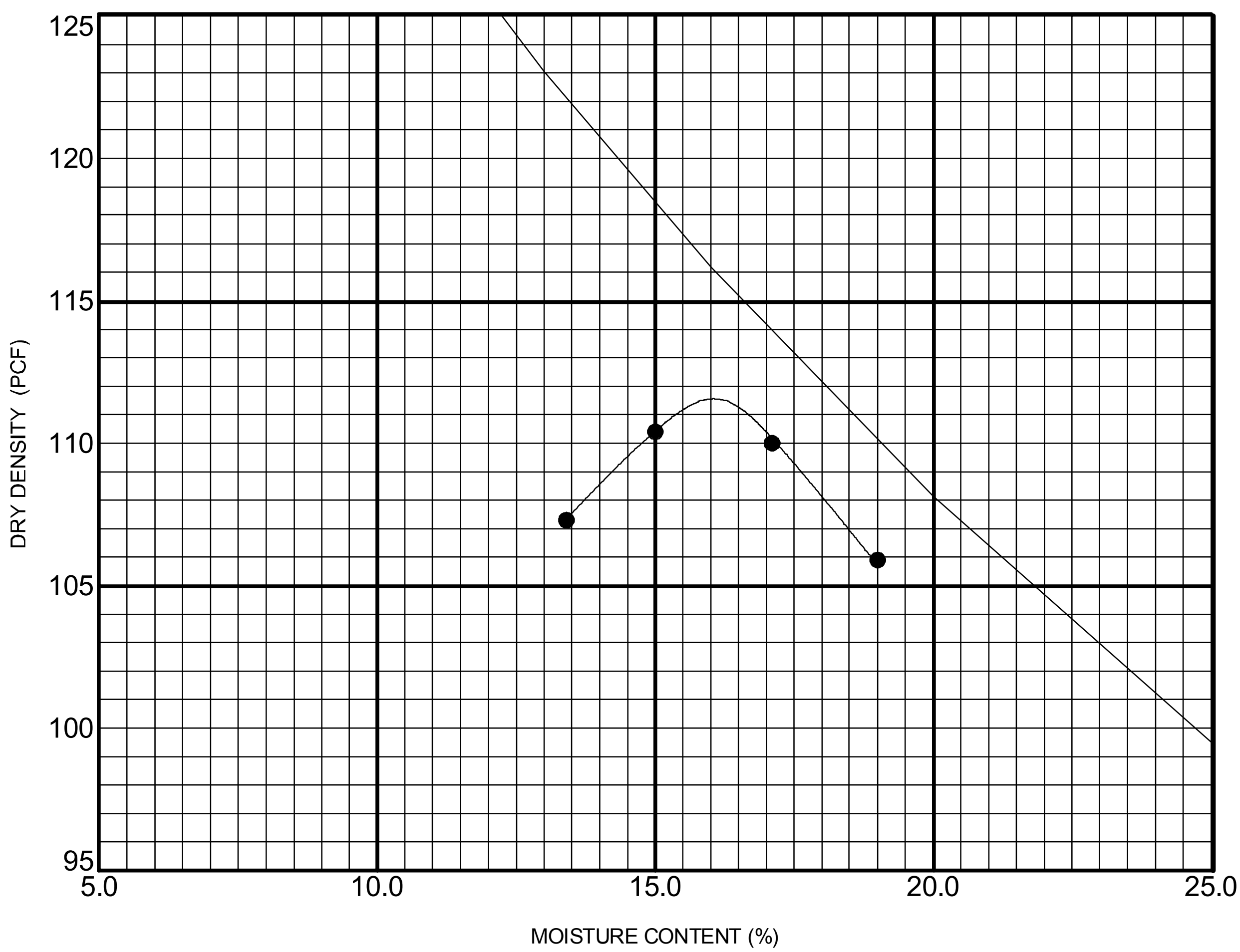
BORING NO.: B- 2 SAMPLE NO.: BS-2 SAMPLE DEPTH: 0 to 5 LABORATORY NO.:

METHOD OF COMPACTION: D698A

LIQUID LIMIT: 36 PLASTIC LIMIT: 18 PLASTICITY INDEX: 18

CLASSIFICATION: CL ASTM SOIL DESCRIPTION: LEAN CLAY with SAND

MAXIMUM DRY DENSITY: **111.5 PCF** OPTIMUM MOISTURE CONTENT: **16.0%**

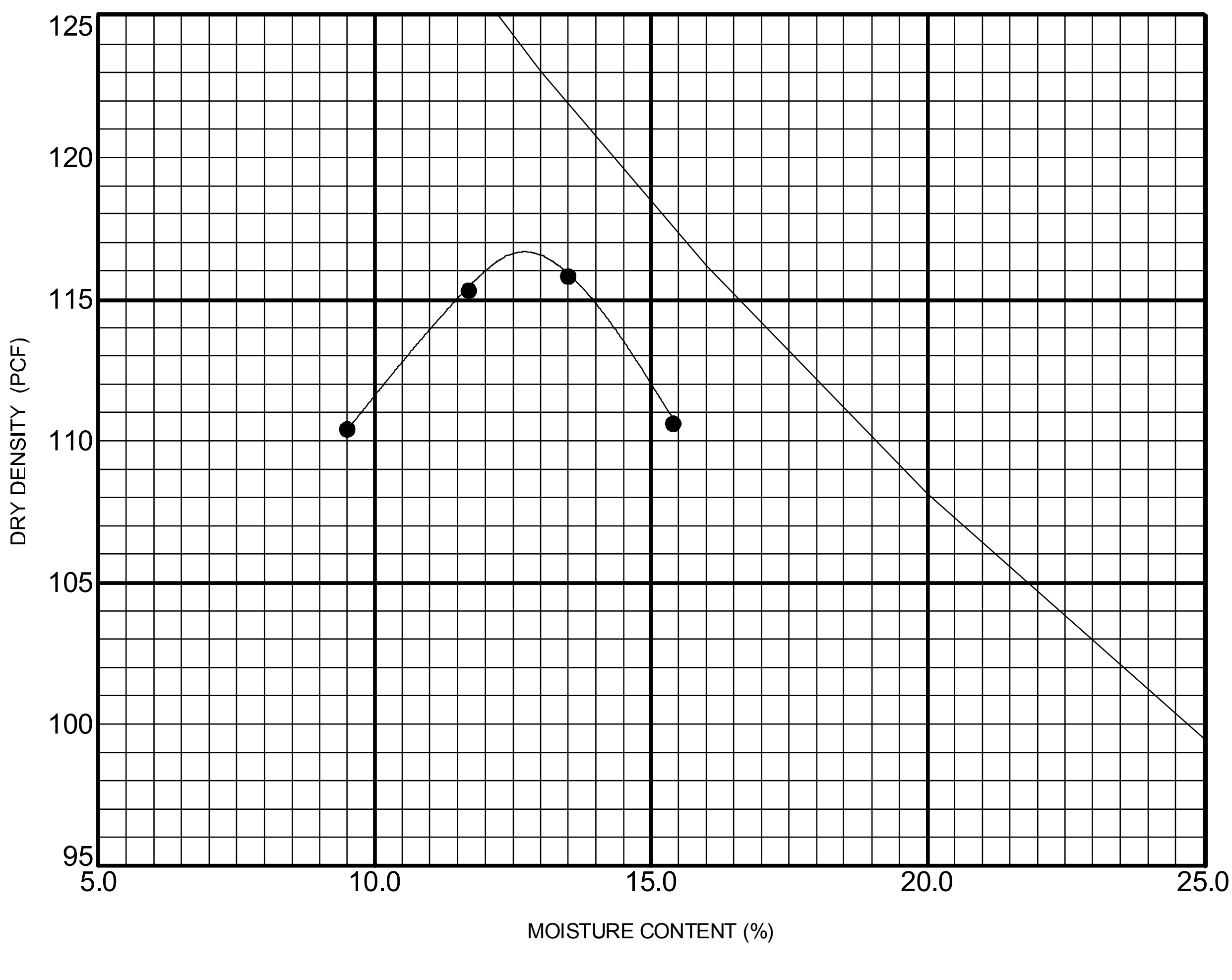


MOISTURE-DENSITY RELATIONS

PROJECT:	Union Office Complex - Mesa				PROJECT NO.: 181744SA
LOCATION:	NWC Cubs Way & Riverview Auto Drive				DATE: 9/10/18
BORING NO.: B-17	SAMPLE NO.: BS-2	SAMPLE DEPTH: 0 to 5			LABORATORY NO.:
METHOD OF COMPACTION:	D698A				
LIQUID LIMIT:	NP	PLASTIC LIMIT:	NP	PLASTICITY INDEX:	NP
CLASSIFICATION:	SM	ASTM SOIL DESCRIPTION:	SILTY SAND		

MAXIMUM DRY DENSITY: **116.8 PCF**

OPTIMUM MOISTURE CONTENT: **12.7%**



GEOTECH PROCTOR 181744SA.GPJ 10/3/18

SPEEDIE AND ASSOCIATES

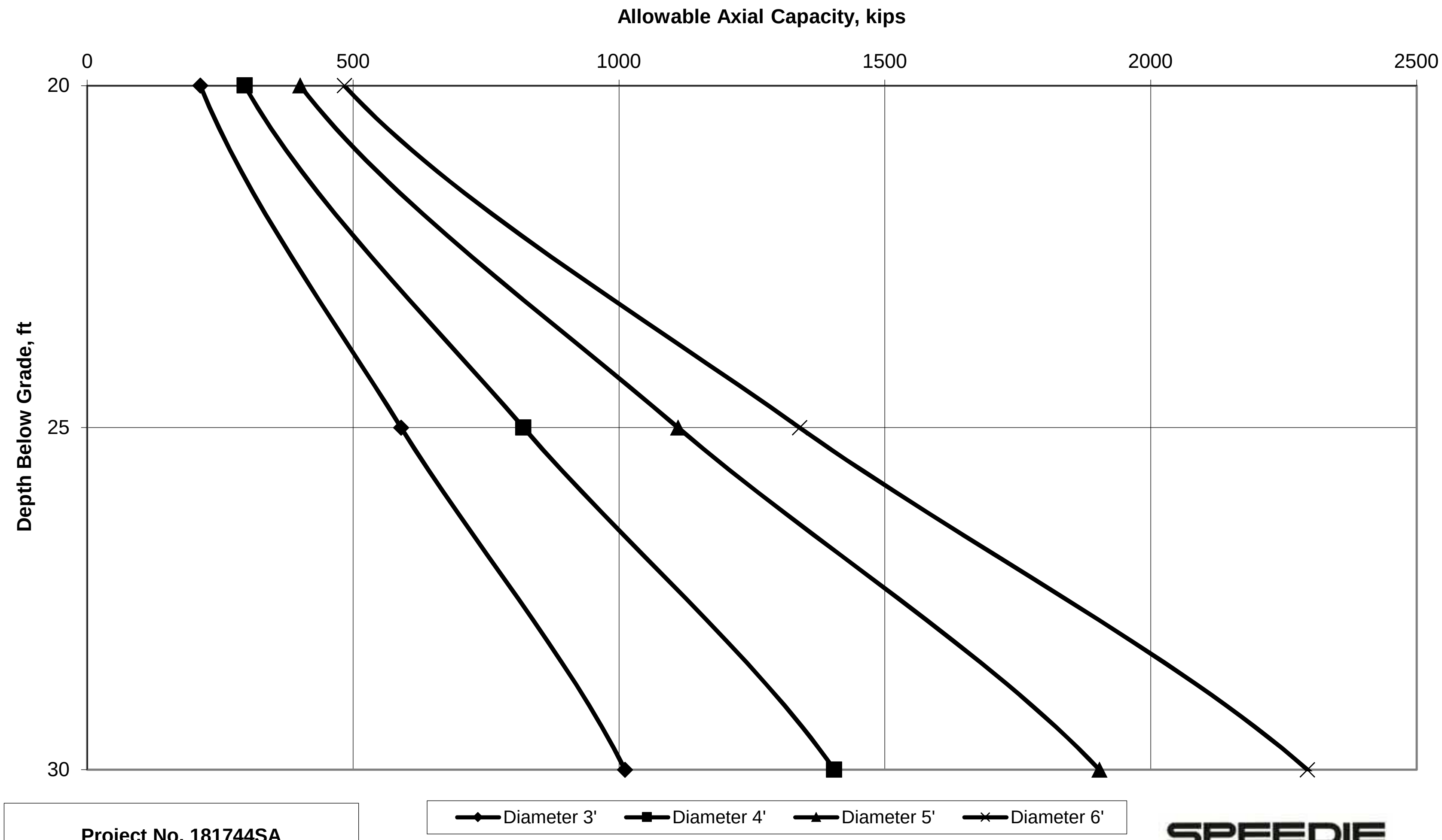
SWELL TEST DATA

BORING or TEST PIT No.	SAMPLE DEPTH, ft	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)	REMOLDED DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	PERCENT COMPACTION	FINAL MOISTURE CONTENT (%)	CONFINING LOAD (psf)	TOTAL SWELL (%)
B- 2, BS-2	5.0	111.5	16.0	105.7	14.4	94.8	22.6	100	4.5
B-17, BS-2	5.0	116.8	12.7	110.7	11.2	94.8	18.1	100	1.1

Union Office Complex - Mesa
NWC Cubs Way & Riverview Auto Drive
Mesa, Arizona
Project No. 181744SA

SPEEDIE AND ASSOCIATES

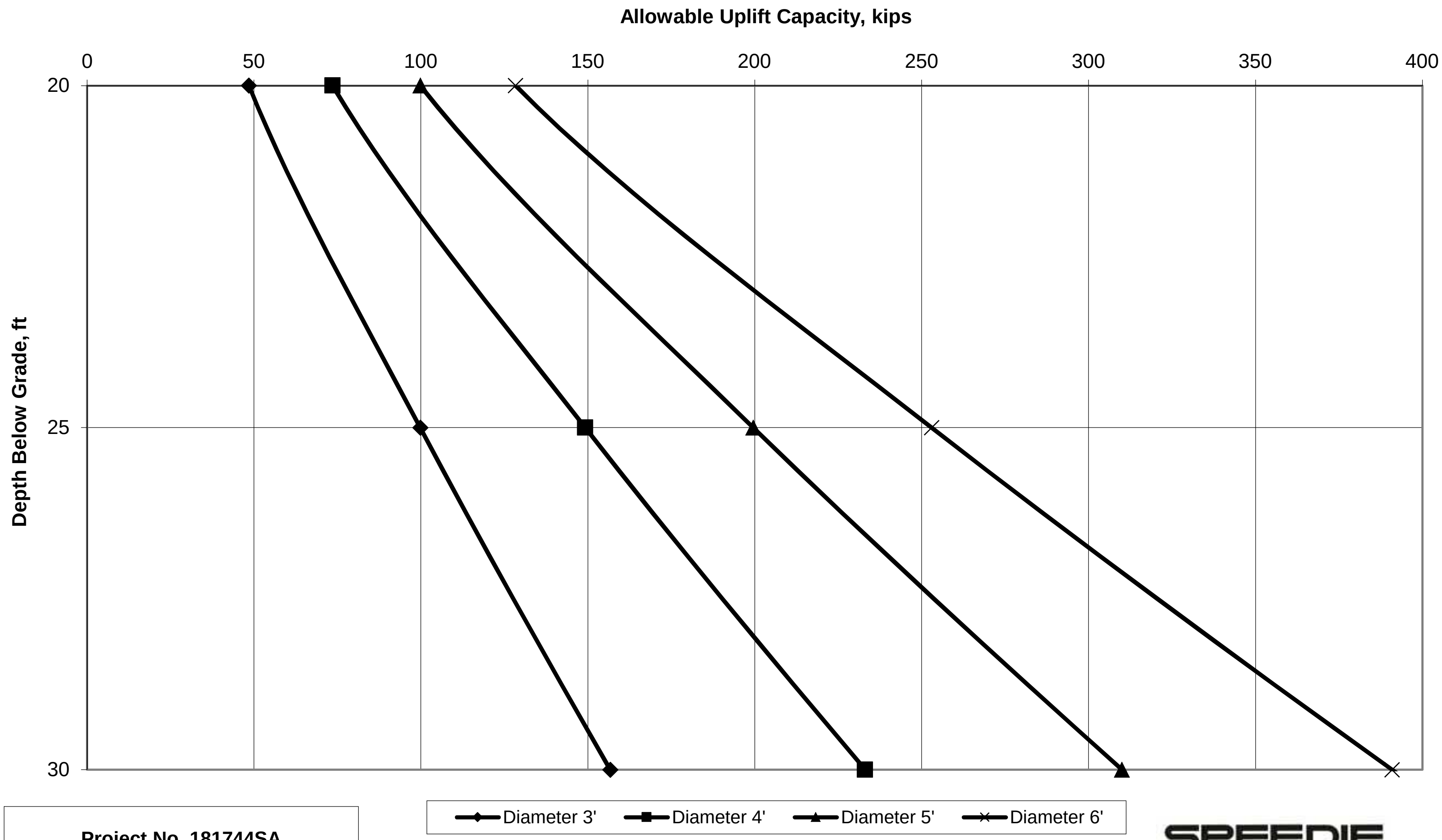
Drilled Shaft Axial Capacity



Project No. 181744SA
Union Office and Garages

SPEEDIE AND ASSOCIATES

Drilled Shaft Uplift Capacity



Project No. 181744SA
Union Office and Garages

SPEEDIE AND ASSOCIATES

APPENDIX B
(Previous Geotechnical Investigations)

Speedie and Associates Report (120372SA)

Speedie and Associates Report (140358SA)

– APPROXIMATE TEST PIT LOCATIONS

– APPROXIMATE SURFACE TEST LOCATIONS

TEST PIT LOCATION PLAN – 2009 AERIAL PHOTO					CUBS STF – FILL INVESTIGATION NWC DOBSON RD & 8TH STREET MESA, ARIZONA	SPEEDIE AND ASSOCIATES GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS 3331 E. WOOD ST. PHOENIX, ARIZONA 85040 (602) 997-6391
DR: BJA	CHK:	REV:	DATE: 10/23/12	PROJECT NO. 120372SA		

– APPROXIMATE TEST PIT LOCATIONS

TEST PIT LOCATION PLAN – 1959 AERIAL PHOTO				
DR: BJA	CHK:	REV:	DATE: 10/23/12	PROJECT NO. 120372SA

CUBS STF – FILL INVESTIGATION
NWC DOBSON RD & 8TH STREET
MESA, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS
3331 E. WOOD ST. PHOENIX, ARIZONA 85040 (602) 997-6391

Depth (feet)	Graphic Log	Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		FILL: SILTY SAND (SM-Dry)						
		FILL: SILTY SAND with GRAVEL (SM-Dry to Moist) with Some Trash Debris						
		POSSIBLE FILL: SILTY, POORLY-GRADED SAND (SP-Dry) with Some Possible Ash	14.0	BS-1	14.0	NT	NT	
		Dense Brown SAND, GRAVEL, and COBBLE (SGC-Dry to Moist)	23.0					
		End of Test Pit						

Depth scale: 0, 5, 10, 15, 20, 25

Equipment Type: **Cat Trackhoe**

Surface Elevation: **N/A**

Excavation Date: **10-19-12**

Field Engineer/Technician: **B. Amos**

Excavator:

Contractor:

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **TP-1**

Cubs Spring Training Facility

NWC 8th Street & Dobson Road

Mesa, Arizona

Project No.: **120372SA**

TEST PIT 120372SA.GPJ GENGEO.GDT 10/31/12

Depth (feet)	Graphic Log	Equipment Type: Cat Trackhoe Surface Elevation: N/A Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 / 25 / 50)
0		Brown FILL: CLAYEY SAND (SC-Dry)						
		Brown FILL: CLAYEY SAND (SC-Dry) with Trash Debris						
5		Appears to be southern end of fill as south side has no fill	5.0	BS-1	5.0	NT	NT	
		Medium Dense Brown CLAYEY, POORLY-GRADED SAND (SP/SC-Dry to Moist)	10.0					
10		Dense Brown SAND, GRAVEL, and COBBLE (SGC-Dry to Moist)	14.0					
15		End of Test Pit						
20								
25								

Excavation Date: **10-19-12**
Field Engineer/Technician: **B. Amos**
Excavator:
Contractor:

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **TP-2**

Cubs Spring Training Facility

NWC 8th Street & Dobson Road

Mesa, Arizona

Project No.: **120372SA**

Depth (feet)	Graphic Log	Equipment Type: Cat Trackhoe Surface Elevation: N/A Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Brown FILL: CLAYEY SAND (SC-Dry)					
		Brown FILL: CLAYEY SAND (SC-Dry) with Trash Debris					
5							
10							
11.0		Dense Brown SAND, GRAVEL, and COBBLE (SGC-Dry to Moist)					
14.0		End of Test Pit					
15							
20							
25							

Excavation Date: 10-19-12
Field Engineer/Technician: B. Amos
Excavator:
Contractor:

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **TP-3**

Cubs Spring Training Facility

NWC 8th Street & Dobson Road

Mesa, Arizona

Project No.: **120372SA**

TEST PIT 120372SA.GPJ GENGEO.GDT 10/31/12

Depth (feet)	Graphic Log	Equipment Type: Cat Trackhoe Surface Elevation: N/A Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Dense Brown SAND, GRAVEL, and COBBLE (SGC-Dry)					
5		5.0 End of Test Pit					
10							
15							
20							
25							

Excavation Date: 10-19-12
Field Engineer/Technician: B. Amos
Excavator:
Contractor:

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **TP-4**

Cubs Spring Training Facility

NWC 8th Street & Dobson Road

Mesa, Arizona

Project No.: **120372SA**

Depth (feet)	Graphic Log	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 / 25 / 50)
0		Brown FILL:CLAYEY SAND (SC-Dry)					
		Brown FILL: CLAYEY SAND (SC-Dry) with Trash Debris					
5		5.0					
		Dense Brown SAND, GRAVEL, and COBBLE (SGC-Dry)					
		8.0					
		End of Test Pit					
10							
15							
20							
25							

Equipment Type: **Cat Trackhoe**

Surface Elevation: **N/A**

Excavation Date: **10-19-12**

Field Engineer/Technician: **B. Amos**

Excavator:

Contractor:

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **TP-5**

Cubs Spring Training Facility

NWC 8th Street & Dobson Road

Mesa, Arizona

Project No.: **120372SA**

TEST PIT 120372SA.GPJ GENGEO.GDT 10/31/12

Depth (feet)	Graphic Log	Equipment Type: Cat Trackhoe Surface Elevation: N/A Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 25 50)
0		POSSIBLE FILL: CLAYEY SAND (SC-Dry) Possible trench fill at north end of test pit						
			2.0					
		Brown CLAYEY SAND (SC-Dry)						
5								
10								
15			15.0					
		End of Test Pit						
20								
25								

Excavation Date: 10-19-12
Field Engineer/Technician: B. Amos
Excavator:
Contractor:

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **TP-6**

Cubs Spring Training Facility

NWC 8th Street & Dobson Road

Mesa, Arizona

Project No.: **120372SA**

TEST PIT 120372SA.GPJ GENGEO.GDT 10/31/12

Depth (feet)	Graphic Log	Equipment Type: Cat Trackhoe Surface Elevation: N/A Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Brown FILL: CLAYEY SAND (SC-Dry) with Trace Trash at North Side of Pit, South Side was Native	3.0					
		Brown CLAYEY SAND (SC-Dry)						
5			6.0					
		Brown SANDY LEAN CLAY (CL-Dry)	10.0					
10		Brown CLAYEY SAND (SC-Dry)	15.0					
15		End of Test Pit						
20								
25								

Excavation Date: 10-19-12
Field Engineer/Technician: B. Amos
Excavator:
Contractor:

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: TP-7

Cubs Spring Training Facility

NWC 8th Street & Dobson Road

Mesa, Arizona

Project No.: 120372SA

TEST PIT 120372SA.GPJ GENGEO.GDT 10/31/12

Depth (feet)	Graphic Log	Equipment Type: Cat Trackhoe Surface Elevation: N/A Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Brown CLAYEY SAND (SC-Dry)						
			3.0					
		Brown POORLY-GRADED SAND (SP-Dry)						
5								
			6.0					
		Brown SAND, GRAVEL, and COBBLE (SGC-Dry)						
			9.0					
		End of Test Pit						
10								
15								
20								
25								

Excavation Date: 10-19-12
Field Engineer/Technician: B. Amos
Excavator:
Contractor:

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: TP-8

Cubs Spring Training Facility

NWC 8th Street & Dobson Road

Mesa, Arizona

Project No.: 120372SA

Depth (feet)	Graphic Log	Equipment Type: Cat Trackhoe Surface Elevation: N/A Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Brown CLAYEY SAND (SC-Dry)					
3.0		Brown POORLY-GRADED SAND (SP-Dry)					
5.0		Brown SAND, GRAVEL, and COBBLE (SGC-Dry)					
9.0		End of Test Pit					
10							
15							
20							
25							

Excavation Date: 10-19-12
Field Engineer/Technician: B. Amos
Excavator:
Contractor:

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: TP-9

Cubs Spring Training Facility

NWC 8th Street & Dobson Road

Mesa, Arizona

Project No.: 120372SA

TEST PIT 120372SA.GPJ GENGEO.GDT 10/31/12

Depth (feet)	Graphic Log	Equipment Type: Cat Trackhoe Surface Elevation: N/A Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 / 25 / 50)
0		Brown FILL PILE: SILTY, CLAYEY POORLY-GRADED SAND WITH GRAVEL, COBBLES, AND TRASH						
5		End of Test Pit	5.0	BS-1	5.0	NT	NT	
10								
15								
20								
25								

Excavation Date: **10-19-12**
Field Engineer/Technician: **B. Amos**
Excavator:
Contractor:

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **SP-1**

Cubs Spring Training Facility

NWC 8th Street & Dobson Road

Mesa, Arizona

Project No.: **120372SA**

TEST PIT 120372SA.GPJ GENGEO.GDT 10/31/12

Depth (feet)	Graphic Log	Equipment Type: Cat Trackhoe Surface Elevation: N/A Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 / 25 / 50)
0–5		Brown <u>FILL PILE: SILTY, CLAYEY POORLY-GRADED SAND WITH GRAVEL, COBBLES, AND TRASH</u> 5.0	BS-1	5.0	NT	NT	
5		End of Test Pit					

Depth scale: 0, 5, 10, 15, 20, 25

Excavation Date: 10-19-12
Field Engineer/Technician: B. Amos
Excavator:
Contractor:

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **SP-2**

Cubs Spring Training Facility

NWC 8th Street & Dobson Road

Mesa, Arizona

Project No.: **120372SA**

TEST PIT 120372SA.GPJ GENGEO.GDT 10/31/12

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer) #200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	ATTERBERG LIMITS LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
SP-1	BS-1	BULK	0.0 - 5.0	NT	NT	15	36	62	66	100	21	17	4	SC-SM	SILTY, CLAYEY SAND with GRAVEL
SP-2	BS-1	BULK	0.0 - 5.0	NT	NT	18	44	76	83	100	24	20	4	SC-SM	SILTY, CLAYEY SAND with GRAVEL
TP-1	BS-1	BULK	0.0 - 14.0	NT	NT	39	62	77	81	100	26	18	8	SC	CLAYEY SAND with GRAVEL
TP-2	BS-1	BS-1	0.0 - 5.0	NT	NT	41	74	80	82	100	23	21	2	SM	SILTY SAND with GRAVEL

Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested

Sheet 1 of 1

Cubs Spring Training Facility
NWC 8th Street & Dobson Road
Mesa, Arizona
Project No. 120372SA

SPEEDIE AND ASSOCIATES

TABULATION OF TEST DATA 120372SA.GPJ GENGEO.GDT 11/1/12

CORROSIVE TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	PERCENT FINER #200 SIEVE	pH	RESISTIVITY (Ohm-Centimeters)	PPM SULFATE (SO4)	PPM CHLORIDE (CL)	SULFIDE (+ or -)	ORGANICS (%)	UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
SP-1	BS-1	BULK	0.0 - 5.0	15	7.6	650	NT	NT	NT	2.3	SC-SM	SILTY, CLAYEY SAND with GRAVEL
SP-2	BS-1	BULK	0.0 - 5.0	18	7.6	760	NT	NT	NT	3.8	SC-SM	SILTY, CLAYEY SAND with GRAVEL
TP-1	BS-1	BULK	0.0 - 14.0	39	7.4	340	NT	NT	NT	3.2	SC	CLAYEY SAND with GRAVEL
TP-2	BS-1	BS-1	0.0 - 5.0	41	7.9	1170	NT	NT	NT	NT	SM	SILTY SAND with GRAVEL

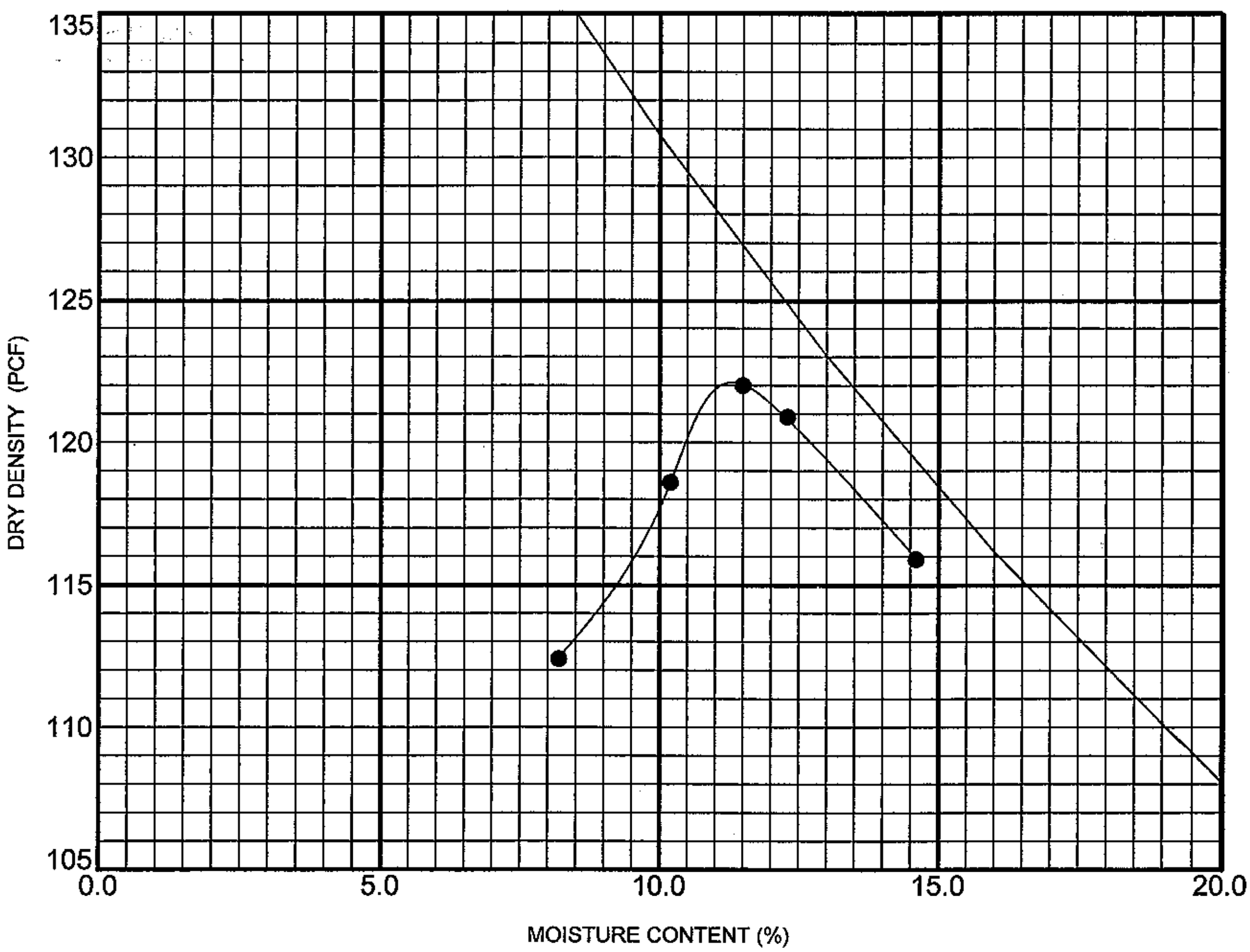
Cubs Spring Training Facility
NWC 8th Street & Dobson Road
Mesa, Arizona
Project No. 120372SA

SPEEDIE AND ASSOCIATES

MOISTURE-DENSITY RELATIONS

PROJECT:	Cubs Spring Training Facility		PROJECT NO.: 120372SA
LOCATION:	NWC 8th Street & Dobson Road		DATE: 10/19/12
BORING NO.: TP-1	SAMPLE NO.: BS-1	SAMPLE DEPTH: 0 to 14	LABORATORY NO.: KN363
METHOD OF COMPACTION:	D698A		
LIQUID LIMIT: 26	PLASTIC LIMIT: 18	PLASTICITY INDEX:	8
CLASSIFICATION: SC	ASTM SOIL DESCRIPTION:	CLAYEY SAND with GRAVEL	

MAXIMUM DRY DENSITY: **122.0 PCF** OPTIMUM MOISTURE CONTENT: **11.5%**

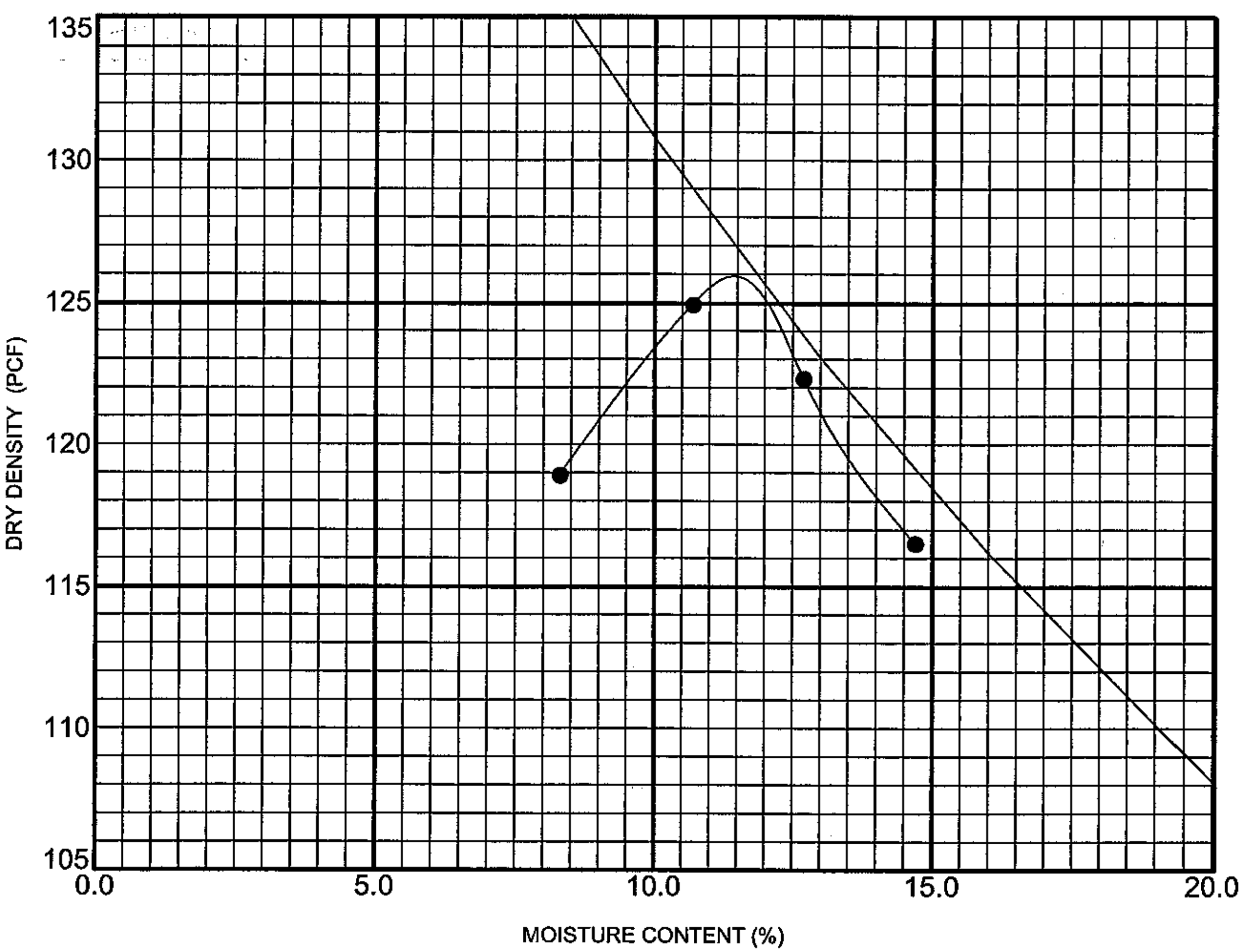


SPEEDIE AND ASSOCIATES

MOISTURE-DENSITY RELATIONS

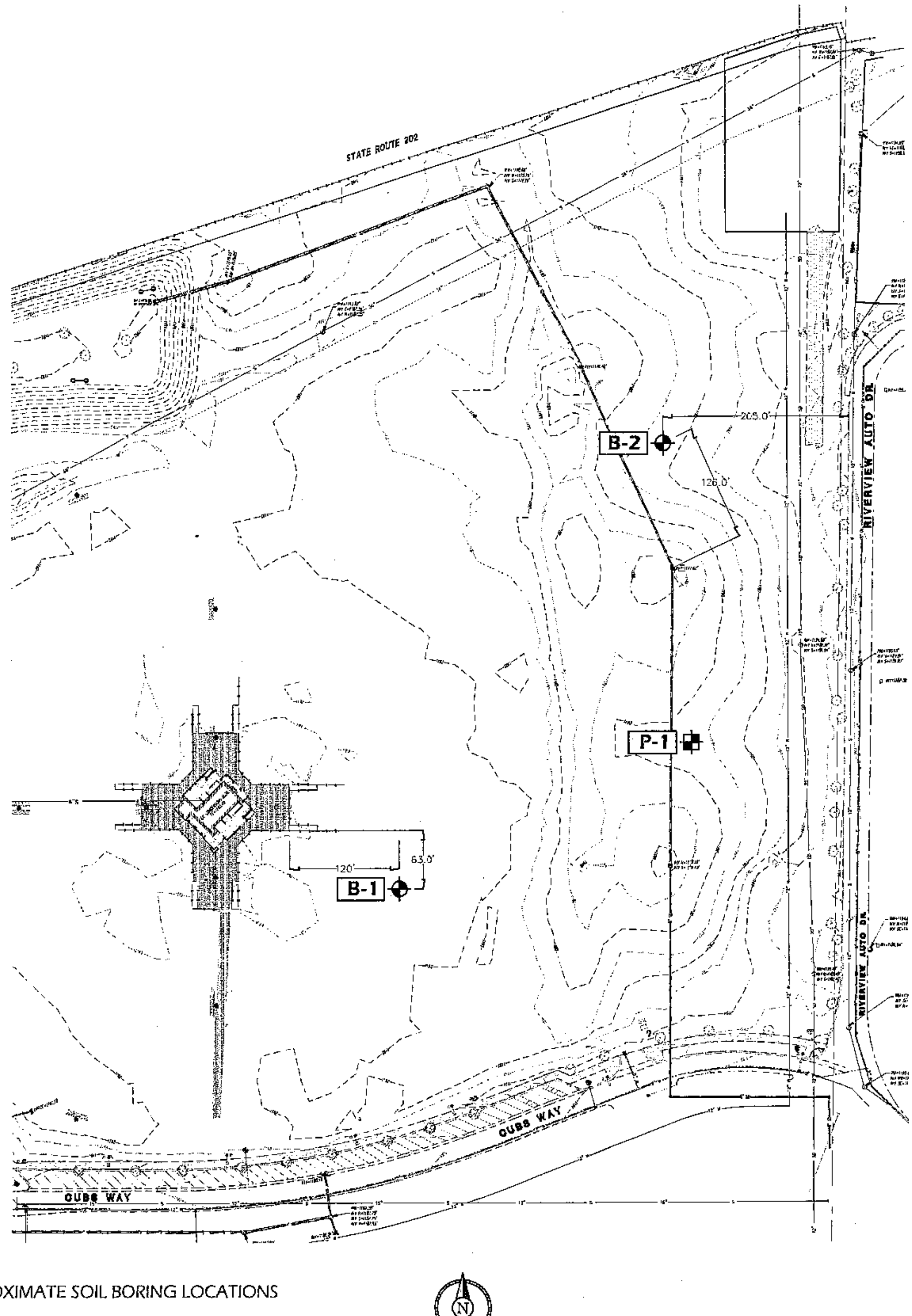
PROJECT: Cubs Spring Training Facility | PROJECT NO.: 120372SA
LOCATION: NWC 8th Street & Dobson Road | DATE: 10/19/12
BORING NO.: SP-1 SAMPLE NO.: BS-1 SAMPLE DEPTH: 0 to 5 | LABORATORY NO.: KN365
METHOD OF COMPACTION: D698A
LIQUID LIMIT: 21 PLASTIC LIMIT: 17 PLASTICITY INDEX: 4
CLASSIFICATION: SC-SM ASTM SOIL DESCRIPTION: SILTY, CLAYEY SAND with GRAVEL

MAXIMUM DRY DENSITY: **125.8 PCF** OPTIMUM MOISTURE CONTENT: **11.2%**



GEOTECH PROCTOR 120372SA.GPJ 10/31/12

SPEEDIE AND ASSOCIATES



- APPROXIMATE SOIL BORING LOCATIONS
- APPROXIMATE PERCOLATION TEST LOCATIONS

DR: TSW	CHK: XXX	DATE: 03/12/14	PROJECT NO. 140358SA	SHEET: 1 OF 1
SOIL BORING LOCATION PLAN		SPRING TRAINING MULT-USE FIELDS NWC OF CUBS WAY AND RIVERVIEW AUTO DRIVE MESA, ARIZONA		SPEEDIE AND ASSOCIATES GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS 3331 E. WOOD ST. PHOENIX, ARIZONA 85040 (602) 997-6391

SOIL LEGEND

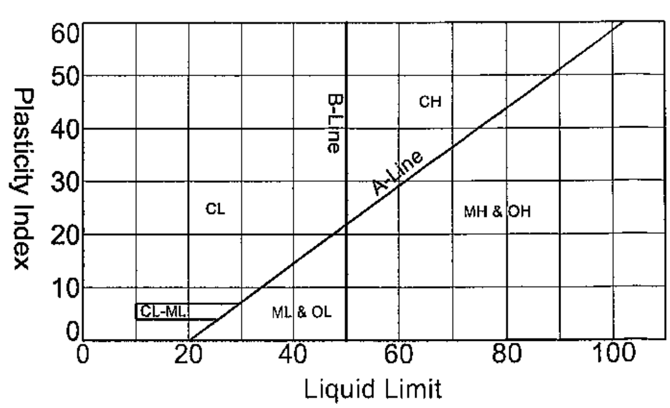
SAMPLE DESIGNATION		DESCRIPTION
AS	**Auger Sample**	Ag rab sample taken directly froma uger flights.
BS	**LargeB ulk Sample**	A grab sample taken froma uger spoils or from bucket of backhoe.
S	**SpoonS ample**	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoons ampler into undisturbed soil for threes uccessive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blowsf or the final 12 inches of penetration is the Standard Penetration Resistance.
RS	**Ring Sample**	Driving a 3.0 inch outside diameter spoon equipped with as eries of 2.42-inch inside diameter,1 -inch longb rass rings, into undisturbed soil for one 12-inch increment by the same means of theS poon Sample. The blows requiredf or the 12 inches of penetration are recorded.
LS	**Liner Sample**	Standard Penetration Test driving a 2.0-inch outside diameter splits poon equipped with two 3-inch long, 3/8-inch inside diameter brass liners, separated bya 1-inch long spacer, into undisturbed soil by the same means of the Spoon Sample.
ST	**Shelby Tube**	A3 .0-inch outside diameter thin-walled tube continuously pushed into the undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).
--	**Continuous Penetration Resistance**	Driving a 2.0-inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same meanso f the spoons ample. The blows for each successive 12-inch increment are recorded.

CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0- 2	0- 0.25	Very Loose	0- 4
Soft	2- 4	0.25 - 0.5	Loose	5- 10
Firm	5- 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9- 15	1- 2	Dense	31 - 50
Very Stiff	16 - 30	2- 4	Very Dense	> 50
Hard	> 30	> 4		

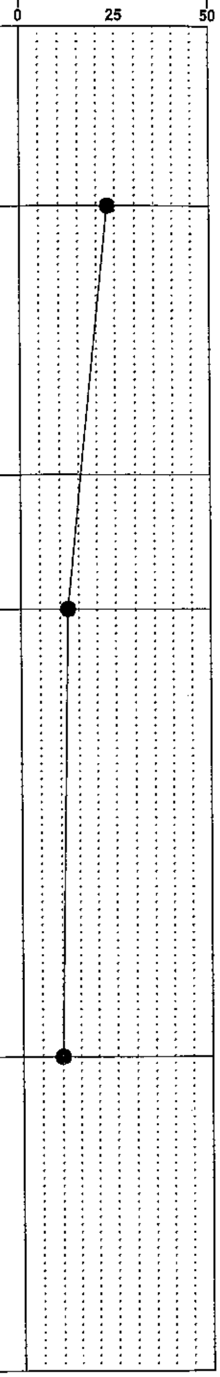
MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE ORNOFINES)		GW	WELL-GRADE DGRAVE LS,GRA VEL - SAND MIXTURES,L ITTLEORNO FI NES
				GP	POORLY-GRADEDG RAVELS,GRA VEL - SANDM IXTURES,LIT TLE ORNO FINES
	MORET HAN50 %O F COARSE FRACTION RETAINEDONNO. 4 SIEVE	GRAVELSWITH FINES (APPRECIABLEAMOUNT OFF INES)		GM	SILTY GRAVELS,G RAVEL- SA ND - SILTM IXTURES
				GC	CLAYEYG RAVELS,G RAVEL- SA ND - CLAYM IXTURES
MORET HAN50 %O F MATERIALIS LARGERT HAN NO. 200SIE VESIZE	SAND AND SANDY SOILS	CLEANSA NDS (LITTLE ORNOFINES)		SW	WELL-GRADEDS ANDS, GRAVELLY SANDS, LITTLEOR NOFI NES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND,LIT TLEOR NOFI NES
	MORET HAN50 %O F COARSE FRACTION PASSINGONNO. 4 SIEVE	SANDSWITH FINES (APPRECIABLEAMOUNT OFF INES)		SM	SILTYSA NDS,SA ND -SIL T MIXTURES
				SC	CLAYEY SANDS, SAND- CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUIDLIM IT LESSTHAN5 0		ML	INORGANIC SILTSANDVERY FINE SANDS,ROCKF LOUR,SI LTY OR CLAYEY FINE SANDSOR CLAYEY SILTS WITHSLI GHTPLASTI CITY
				CL	INORGANICCLAY SO F LOW TO MEDIUMPLASTICI TY,GRAVELLY CLAYS,SANDYCL AYS, SILTY CLAYS, LEANCL AYS
				OL	ORGANICSIL TS ANDO RGANIC SILTY CLAYSOF LOWPLAS TICITY
MORET HAN50 %O F MATERIALIS SMALLERT HANNO. 200SIE VESIZE	SILTS AND CLAYS	LIQUIDLIM IT GREATER THAN5 0		MH	INORGANICSIL TS,MI CACEOUS OR DIATOMACEOUSFINESANDOR SILTY SOILS
				CH	INORGANICCLAY SO F HIGH PLASTICITY
				OH	ORGANICCLAY SOF MEDIUM TO HIGH PLASTICITY, ORGANICSIL TS
HIGHLYOR GANICSOILS				PT	PEAT,HUM US,SWA MPSOILSWITH HIGH ORGANICCO NTENTS

NOTE: DUAL OR MODIFIED SYMBOLS MAY BE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS OR TO PROVIDE A BETTER GRAPHICALP RESENTATION OF THE SOIL

MATERIAL SIZE	PARTICLE SIZE			
	Lower Limit		Upper Limit	
	mm	Sieve Size ♦	mm	Sieve Size ♦
SANDS				
Fine	0.075	#200	0.42	#40
Medium	0.420	#40	2.00	#10
Coarse	2.000	#10	4.75	#4
GRAVELS				
Fine	4.75	#4	19	0.75" ×
Coarse	19	0.75" ×	75	3" ×
COBBLES	75	3" ×	300	12" ×
BOULDERS	300	12" ×	900	36" ×
♦U.S. Standard		×Clear Square Openings		



Depth (feet)	Graphic Log	Rig Type: CME-75 Boring Type: Hollow Stem Auger Surface Elevation: N/A Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Very Stiff Brown <u>LEAN CLAY</u> (CL-Dry) with Sand, Trace Roots					
			RS-1	2.0	NT	NT	
		3.0					
		Medium Dense Light Brown <u>FINE SAND with SILT</u> (SP/SM-Dry)					
5			BS-2	5.0	NT	NT	
			S-3	6.5	NT	NT	
		8.0					
		Loose Light Brown <u>POORLY GRADED FINE SAND</u> (SP-Dry)					
10							
		11.5	S-4	11.5	NT	NT	
		End of Boring					
15							



Boring Date: 3-12-14
Field Engineer/Technician: K. Euge II
Driller: R. Rodriguez
Contractor: Geomechanics SW

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-1**

Spring Training Multi-Use Fields

NWC of Cubs Way and Riverview Auto Drive

Mesa, Arizona

Project No.: **140358SA**

_SPEEDIE 140358SA.GPJ GENGEO.GDT 3/18/14

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Stiff Brown <u>LEAN CLAY</u> (CL-Dry) with Trace Roots					
		S-1	2.5	NT	NT	
3.0	Medium Dense Light Brown <u>POORLY GRADED FINE SAND with SILT</u> (SP/SM-Dry)					
5						
6.0	Stiff Brown <u>SANDY LEAN CLAY</u> (CL-Dry) with Weak Calcareous Cementation	S-2	6.5	NT	NT	
7.5	Dense Brown <u>WELL GRADED SAND</u> (SW-Dry) with Gravel					
10						
11.5	End of Boring	S-3	11.5	NT	NT	
15						

Boring Date: **3-12-14**
Field Engineer/Technician: **K. Euge II**
Driller: **R. Rodriguez**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-2**

Spring Training Multi-Use Fields

NWC of Cubs Way and Riverview Auto Drive

Mesa, Arizona

Project No.: **140358SA**

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
B-1	BS-2	BULK	0.0 - 5.0	NT	NT	76	98	100	100	100	31	18	13	CL	LEAN CLAY with SAND
B-2	S-1	SS	1.0 - 2.5	NT	NT	86	99	100	100	100	32	19	13	CL	LEAN CLAY

Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested

Sheet 1 of 1

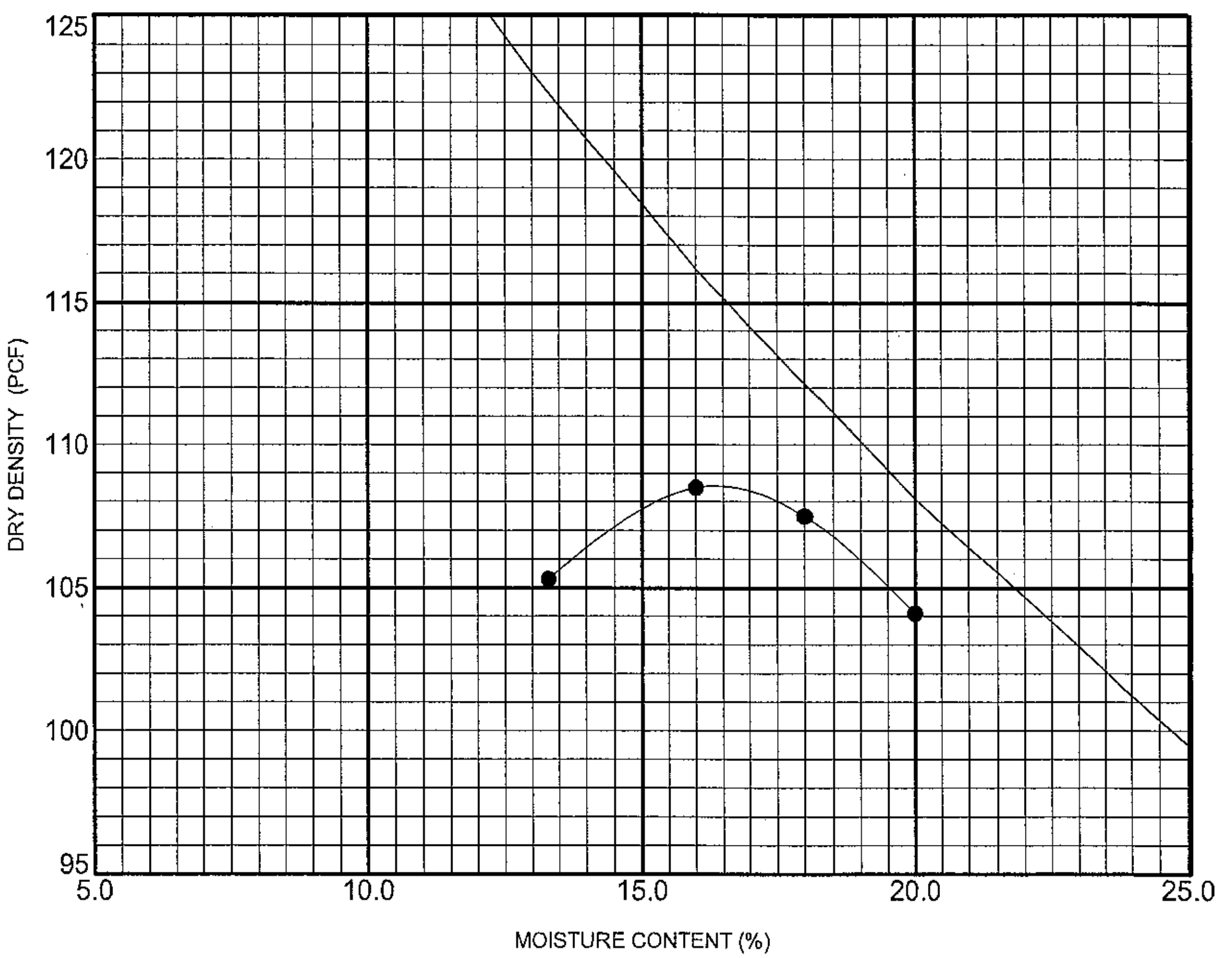
Spring Training Multi-Use Fields
NWC of Cubs Way and Riverview Auto Drive
Mesa, Arizona
Project No. 140358SA

SPEEDIE AND ASSOCIATES

MOISTURE-DENSITY RELATIONS

PROJECT: Spring Training Multi-Use Fields PROJECT NO.: 140358SA
LOCATION: NWC of Cubs Way and Riverview Auto Drive DATE: 3/12/14
BORING NO.: B-1 SAMPLE NO.: BS-2 SAMPLE DEPTH: 0 to 5 LABORATORY NO.:
METHOD OF COMPACTION: D698A
LIQUID LIMIT: 31 PLASTIC LIMIT: 18 PLASTICITY INDEX: 13
CLASSIFICATION: CL ASTM SOIL DESCRIPTION: LEAN CLAY with SAND

MAXIMUM DRY DENSITY: **109.2 PCF** OPTIMUM MOISTURE CONTENT: **16.9%**



GEOTECH PROCTOR 140358SA.GPJ 3/18/14

SPEEDIE AND ASSOCIATES